Altered and Adorned

Using Renaissance Prints in Daily Life

SUZANNE KARR SCHMIDT

WITH KIMBERLY NICHOLS

THE ART INSTITUTE OF CHICAGO
YALE UNIVERSITY PRESS
NEW HAVEN AND LONDON

NE441.5.R44 S355 2011
Schmidt, Suzanne Kathleen
Karr
Altered and adorned : using
Renaissance prints in daily

Altered and Adorned: Using Renaissance Prints in Daily Life
has been published in conjunction with an exhibition of the same title, organized by and
presented at the Art Institute of Chicago from April 30 to July 10, 2011.

Major funding for this book has been provided by a grant for scholarly catalogues and publications from the Andrew W. Mellon Foundation.

Generous support for the exhibition is provided by the Exhibitions Trust: Goldman Sachs, Kenneth and Anne Griffin, Thomas and Margot Pritzker, the Earl and Brenda Shapiro Foundation, Donna and Howard Stone, Mr. and Mrs. Paul Sullivan, and an anonymous donor.

© 2011 The Art Institute of Chicago
All rights reserved. No part of this publication may be reproduced, transmitted, or utilized in any form or by any means, electronic or mechanical, including photocopy, digital recording, or any other information storage and retrieval system (beyond that copying permitted by Sections 107 and 108 of the U.S. Copyright Law), without prior written permission from the Publications Department of the Art Institute of Chicago, except by a reviewer who may quote brief passages in a review.

First edition
Printed in the United States of America
Library of Congress Control Number: 2011923770
ISBN 978-0-300-16911-9

Published by The Art Institute of Chicago
111 South Michigan Avenue
Chicago, Illinois 60603–6404
www.artic.edu

Distributed by Yale University Press
P.O. Box 209040
302 Temple Street
New Haven, Connecticut 06520–9040
www.yalebooks.com/art

Produced by the Publications Department of the Art Institute of Chicago, Robert V. Sharp, Executive Director
Edited by Amy R. Peltz
Production by Sarah E. Guernsey and Clo Pazera
Photography editing by Joseph Mohan
Designed and typeset in Requiem and Gotham Narrow by Joan Sommers Design, Chicago
Separations by Professional Graphics, Inc., Rockford, Illinois
Printing and binding by Classic Color, Inc., Broadview, Illinois

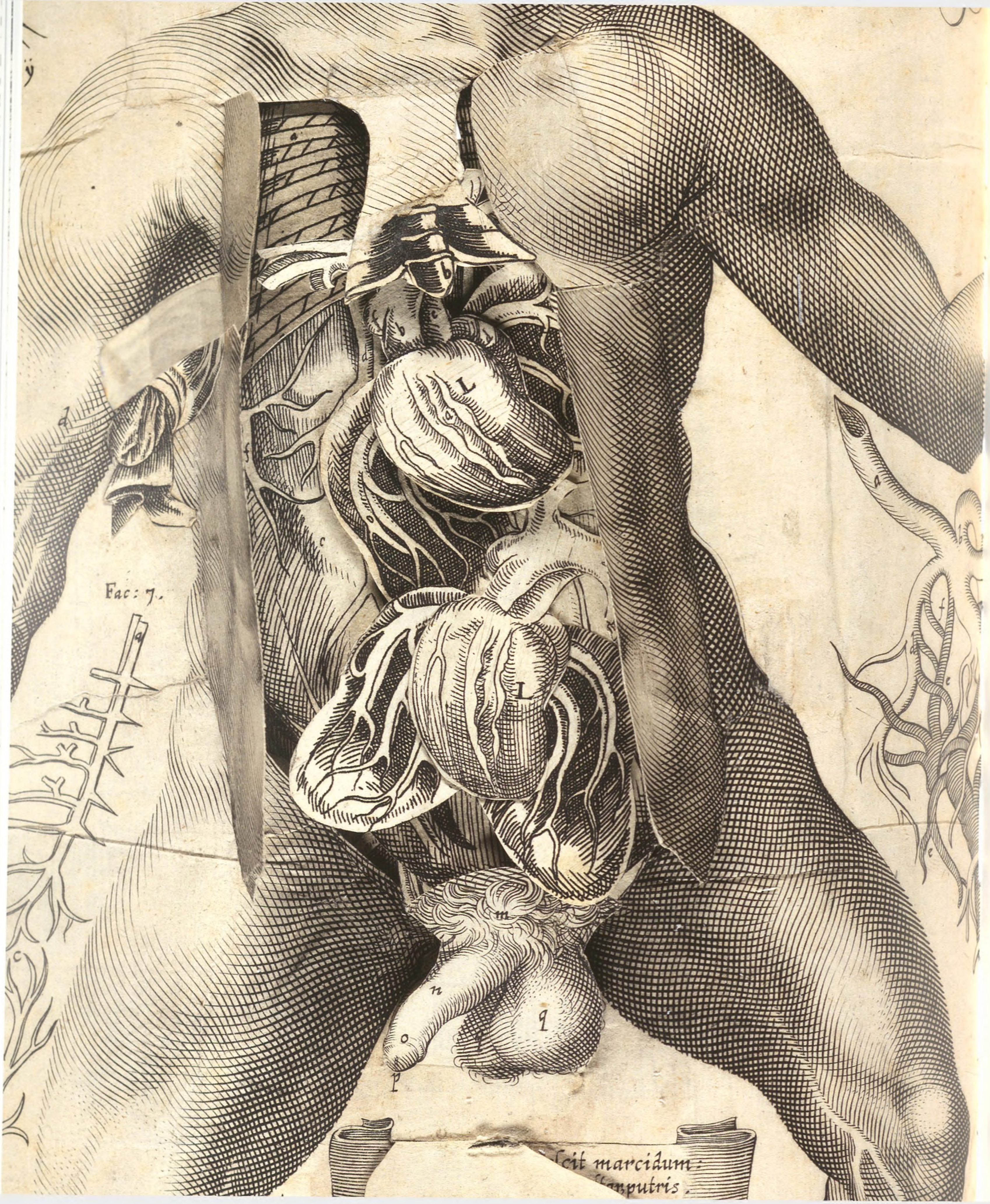
Photography Credits

Images of objects in the collection of the Art Institute of Chicago were produced by its Department of Imaging, Christopher Gallagher, Director.

Unless otherwise noted, all photographs of artworks from public and private collections appear by permission of those institutions. The following credits apply to all images for which separate acknowledgment is due.

Fig. 43: Photograph © Trustees of the British Museum. Fig. 47: Courtesy of the Blanton Museum of Art, the University of Texas at Austin. Photograph by Rick Hall. Fig. 48: Courtesy of the Library of Congress. Photograph by Nancy Behall, Department of Imaging, the Art Institute of Chicago. Figs. 57, 59A–B: Courtesy of Loyola University Museum of Art, Martin D'Arcy Collection. Figs. 69A–B: Courtesy of Adler Planetarium and Astronomy Museum, Chicago, Illinois. Figs. 76–78: Courtesy of the Galter Health Sciences Library Special Collections, Feinberg School of Medicine, Northwestern University, Chicago, Illinois.

Front cover: Lucas Kilian, *Second Vision* (Adam) from *Mirrors of the Microcosm* (detail), 1613 (fig. 72). Back cover: Workshop of the Master of the Very Small Hours of Anne of Brittany, *The Nativity*, in a coffer, c. 1490 (fig. 49). Frontispiece: Digitally cutout details of Agostino Carracci, *Headpiece in the Form of a Fan*, c. 1589 (fig. 41).


a
b
b
c
d
f
L
a
d
f
c
Fac: 7.
a
L
a
d
f
c
e
c
m
n
o
q
p
ſcit marcidum:
ſtanputris.

PRINTED SCIENTIFIC OBJECTS

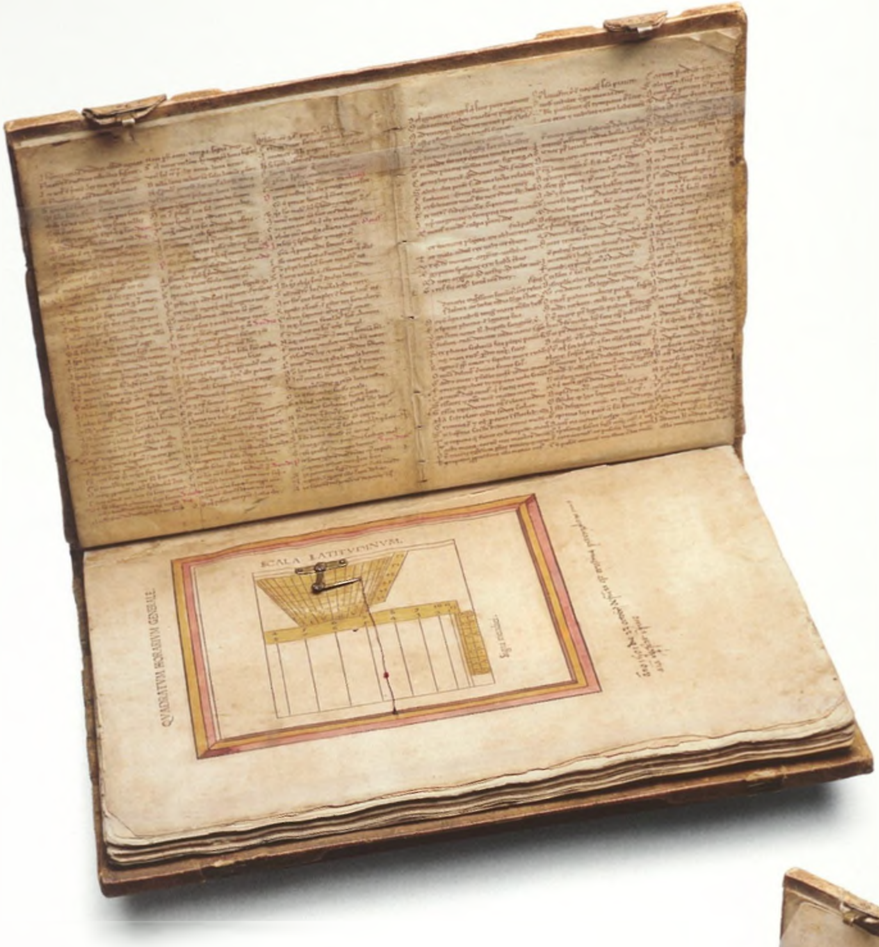
From the late fifteenth century, printing became increasingly interactive in a variety of ways that served a range of proto-scientific purposes.[1] Like the consecrated host and the medicinal-ritual associations of the edible Madonnas, scientific instrument prints and anatomy flap diagrams constituted an attempt to understand and control the user's environment. They complemented popular broadsides interpreting the significance of the movement of celestial bodies; sharing news of newly discovered species of wild animals, like Albrecht Dürer's *Rhinoceros* (cat. 21); announcing freakish abnormalities in domestic species, as in Dürer's *Monstrous Sow of Landser* (cat. 19); or reporting aberrant human births. Normal human anatomy too could be studied and drooled or gawked at in more elaborate broadsides layered with liftable flaps depicting internal organs. Barber-surgeons may have displayed rudimentary examples for their customers, and medical students consulted the more detailed variety in the anatomy theater. More editions of female flap anatomies appear to have been produced than male ones, suggesting that their nearly naked charm offered an additional motivation for buyers. Prints also formed composite instruments for measuring time. Calendars with astronomical and astrological themes emerged and developed to include movable parts such as rotating dials that charted lunar movements. Mass-produced paper instruments appeared in books, and as early as the sixteenth century there were paper veneers that could be pasted down on more permanent supports such as wood or pasteboard. These became inexpensive yet functional horological, navigational, and surveying devices.

Printed Instruments

At the heart of the need to locate oneself in time and space was the calendar, one of the many ways man organized time, and one of the first to be printed in the form of books or sheets to be hung on the wall. At its simplest, the so-called *Bauernkalendar*, or peasant calendar, functioned as a type of broadsheet wall almanac with medical-astrological underpinnings, suggesting the most propitious times to plant fields, marry, or conceive and bear children. At its most complicated, it included astronomical information and interactive time-telling instruments. Johannes Müller, called Regiomontanus, was a prolific writer, mathematician, and instrument maker. He moved to the flourishing imperial trade city of Nuremberg from the University of Vienna in order to have his instruments fabricated in brass by the town's excellent craftsmen. Like the printed books of hours for the Use of Paris made by Philippe Pigouchet for Simon Vostre discussed above, Regiomontanus's universal sundial illustrations, and the more far-reaching Nuremberg printed sundials by Georg Hartmann and others that followed, were both portable and bound by the particular geographical use—generally an area of central Europe—that their range of latitudes permitted. The religious system of hours was generally more adaptable than the latitude-enforced specificity of local time, as the former ritual sequence allowed variation of response and a choice of local saint's feast days, but individuals learned to make both types their own.

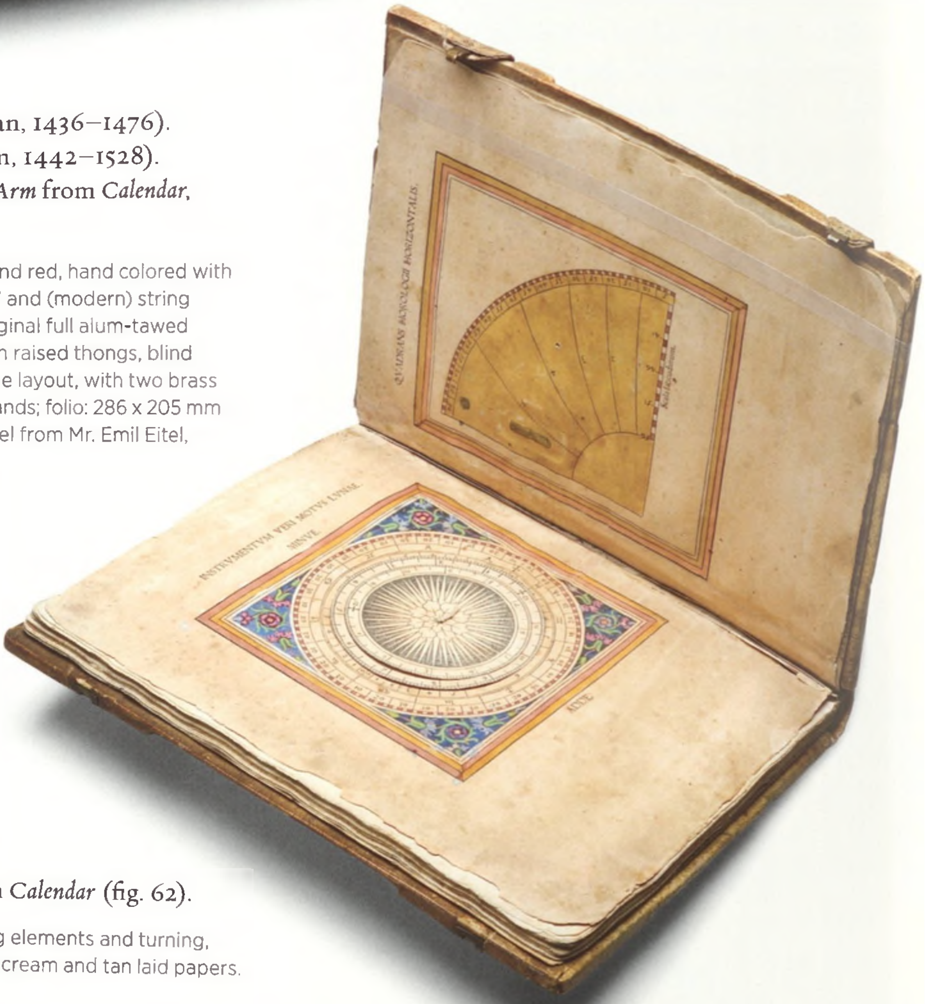
Soon after Regiomontanus set up his own book press in Nuremberg, he printed one of the first

61. Detail of *Second Vision (Visio Secunda)* from *Mirrors of the Microcosm (Catoptri Microcosmici)* (fig. 72).



62. Johannes Regiomontanus (German, 1436–1476). Published by Erhard Ratdolt (German, 1442–1528). ***Universal Sundial with an Articulated Brass Arm*** from *Calendar*, Venice, 1476.

Book with woodcut and letterpress in black and red, hand colored with brush and watercolor, pen and ink, with metal and (modern) string elements on cream and tan laid papers, in original full alum-tawed pigskin over beveled wooden boards, sewn on raised thongs, blind tooled "all-over" with small tools in an H-frame layout, with two brass hook-clasp fastenings, and hand-sewn headbands; folio: 286 x 205 mm (11¼ x 8 1/16 in.). Gift in memory of Mrs. Emil Eitel from Mr. Emil Eitel, 1948.343.



63. *Lunar Volvelle Dial* and *Quadrant* from *Calendar* (fig. 62).

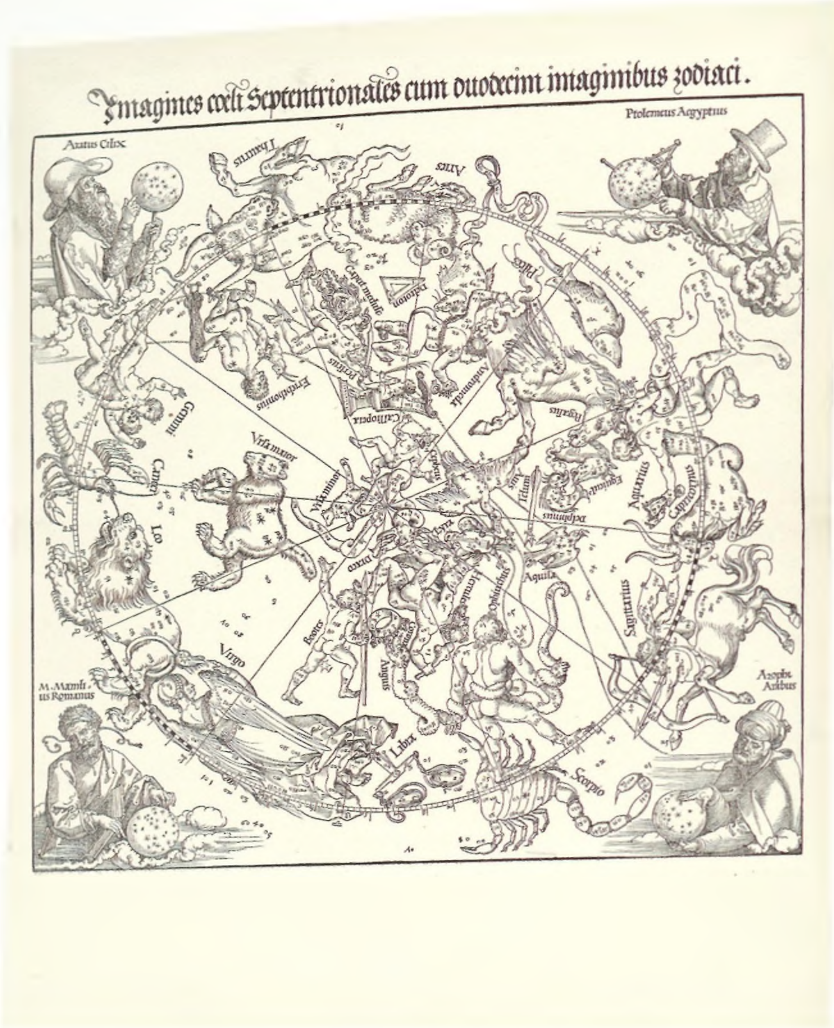
Book with woodcut and letterpress with string elements and turning, stacked dial, hand colored with watercolor on cream and tan laid papers.

nonreligious bestsellers, his 1474 *Calendar*, in Latin and German editions. Not only did this work include an extensive calendar of the obligatory feast days that would open any book of hours and offered a table to determine the date of the next Easter, it also included several innovative applications of print. The Art Institute's 1476 Latin edition pirated by Erhard Ratdolt is very similar in its production values. After a full lunar cycle of woodcuts (with the moon distinctively hand colored in yellow following Regiomontanus's original publication), it closes with a series of three instruments used to measure time throughout Europe and a lunar volvelle diagram with a stack of moving dials that could be positioned to predict later parts of the cycle (fig. 63). A quadrant appears on the opposite page, which, like the sector for unequal hours on the preceding page, used an index string to tell time in a specific latitude. The final woodcut in the book, labeled QVADRATVM HORARIVM GENERALE, is a more flexible universal horary square that tells time throughout numerous latitudes (fig. 62).

This device brings Regiomontanus's instrument training to the fore, as he designed an articulated brass arm that punched through the thick pasteboard sheet, the base of which can be seen in the quadrant on the other side. A string attached to the end of the moving arm could be positioned to tell time at most European latitudes, sixty-two of which appear in the book's handy chart ranging from Nuremberg to Rome, Paris to Prague. Latin annotations throughout the Chicago volume in a consistent hand show that this copy was consulted for nearly thirty years after publication. Indeed, Regiomontanus's calendar professed its longstanding utility, with a table giving the dates of Easter until 1531, and solar charts valid until 1534. The annotator uses the margins of the opening monthly calendar to establish a family chronicle, commenting on the dates of birth and death of several children, with particular details about the horoscope of his son Johannes, who was born on January 12, 1489, with the moon in Leo rising.[2] The writer even adds his own feast day to the calendar in a slot left blank but underlined at the bottom of the month of September, another of Regiomontanus's typographical idiosyncrasies.

Another Latin inscription under the universal dial on the last page comments at greater length on another death: *In the year 1501 on October 23, died Christina Peterzaleni [. . .] may she rest in peace.* Christina was perhaps the writer's wife, for a similar inscription appears in the margin of the October calendar page in German. His placement of the second inscription under the last printed instrument of the book bears closer inspection. This woodcut is actually turned ninety degrees clockwise on the page and would have to be reoriented for the device to function. Nonetheless, the placement of the phrase there and other inscriptions in the book imply that the writer was curious about instrumentation. A text written on the page before the group of instruments implicitly refers to horoscopes, as it mentions Saturn and the sun and moon, among other planets (but not Easter, the dating table beneath which the writing appears). Astrology was another activity the instruments could support. The universal dial lacks the original beaded string that would have been threaded through the arm to cast a shadow on the time of day, but the surface of the woodcut under the lower joint of the brass arm has been conspicuously rubbed at the forty-eighth latitude.[3] This suggests that the owner actually used the device, shifting the arm and its lower joint to orient the index string and its bead for different geographical locations. In addition, both the dial for unequal hours and the quadrant have pinholes at the point where a string would be inserted. The original cord for one of these sun instruments has in fact survived, though it ended up in the book's gutter. This cord is quite coarse with a waxy exterior coating similar to the knotted cord used to secure the volvelle, thus both are probably original.

Regiomontanus's *Calendar* was pirated by printers in Germany and Italy immediately and into the sixteenth century. Its most conscientious copier, the aforementioned Erhard Ratdolt, a German then running a printing house in Venice, took pains to copy the original functions of the volume, and in the Art Institute *Calendar*, he has retained both the thicker paper for the instrument pages and the swiveling metal element for the final universal dial. The decorative touches are slightly more ornate than Regiomontanus's throughout. Even the uncolored volvelle dial bears a floral accent of white petals on a black background. An owner brilliantly illuminated the spandrels around the dial in opaque reds and greens on a blue ground, picked out the minute squares in red, and tinted the outer borders in yellow-brown and rose transparent



64. Albrecht Dürer (German, 1471–1528). *Celestial Map of the Northern Sky (Imagines coeli septentrionalis)*, 1515.

Woodcut on ivory laid paper; image: 432 x 430 mm (17 x 16 15/16 in.); sheet: 584 x 463 mm (23 x 18¼ in.). Kate S. Buckingham Fund, 1964.1065.

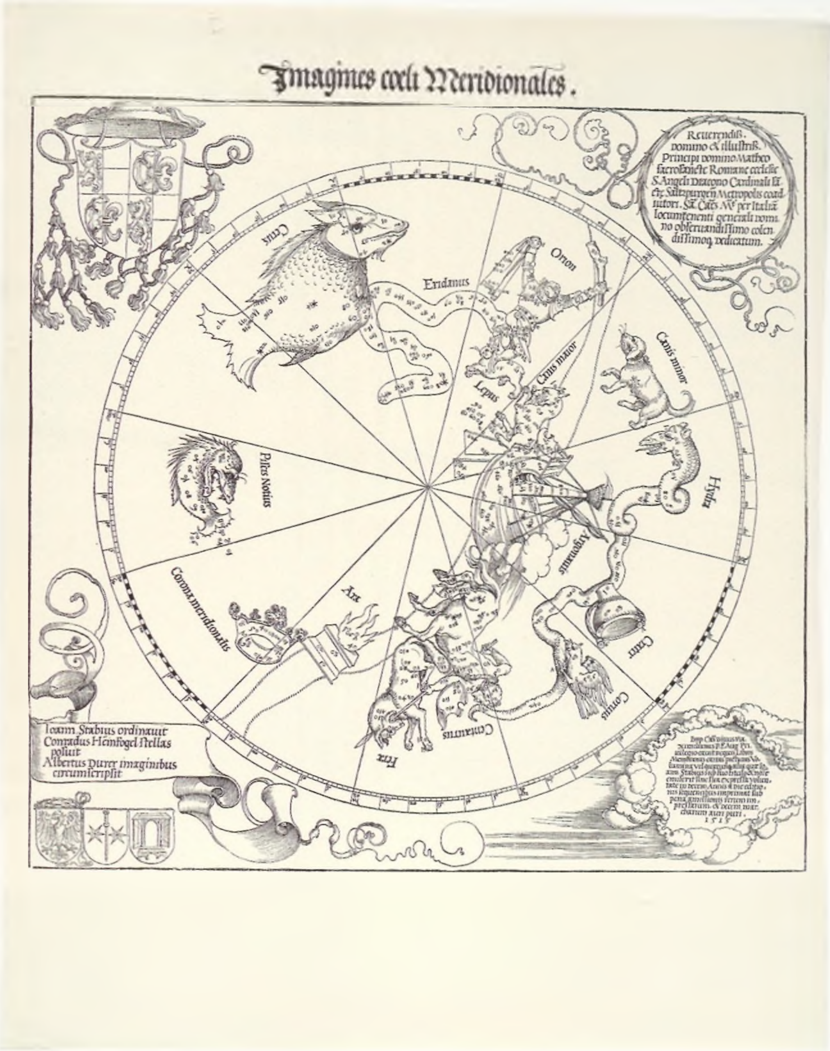
watercolor. This diagram too bears unambiguous signs of use—traces of red wax and manuscript scrap reinforcements. The wax smudged under the lower dial would have secured it in place temporarily, just as for broadsheets on walls. The user could then manipulate the upper dial to fine-tune calculations without fear of slippage. The quadrant on the following page has been painted with tan watercolor, as if to simulate the look of brass, while the universal dial is partially colored in this tone. All the instruments are set in tripartite borders that take on a hint of three-dimensionality when painted, quite possibly by the user, as only the hand coloring of the lunar cycle is consistent in each edition.

While he copied Regiomontanus quite closely, Ratdolt was a printmaking pioneer in his own right, experimenting with colored and gold inks in his Venice and later Augsburg printing facilities. He may have inspired Hans Burgkmair's gold and black printing of the portrait of Maximilian I (fig. 12), as the artist worked for him between 1491 and 1502, and Maximilian's counselor Conrad Celtis was well aware of Ratdolt's innovations.[4] Ratdolt also printed decorative woodcut book covers, and even allowed for further personalization of the 1476 *Calendar* by leaving a blank coat of arms in the title page border, which has in this copy been filled in with a drawing of a white rooster on a red field. This frontispiece has been identified as the earliest modern title page, an advance that appeared nowhere else until 1500.[5] It lists the title, date, and production team (the artist, Ratdolt, and his copublisher) in a novel and clear fashion, while the cast-metal borders are equally innovative in both their technique and their delicate classical ornaments and floral vases.

Regiomontanus's *Calendar* instruments were printed on doubled paper hardy enough for them to be cut out and used separately, and this was also true of Ratdolt's pirated editions. Over fifty years later, a new genre of Nuremberg printed timepiece invented by the local priest, mathematician, and printer Georg Hartmann would go even further to improve their accuracy and availability. Unlike wall sundials that would be affixed permanently to face the sun, most printed sundials, astrolabes, and other such devices were meant to be portable and, often, when packaged as folding diptychs, pocket-sized. The instruments were particularly suited to traveling merchants and nobles, but the trade expanded to serve a wider audience, from royalty to students. Printed instruments must have attracted as much patronage as the costlier metal objects they copied, as editions survive that suggest a vogue for distributing them decorated with specific coats of arms. Other designers left blank shields on instruments allowing personalizations to be added freehand to constructed impressions, much as could be done in the Otto print heraldic lacunas.

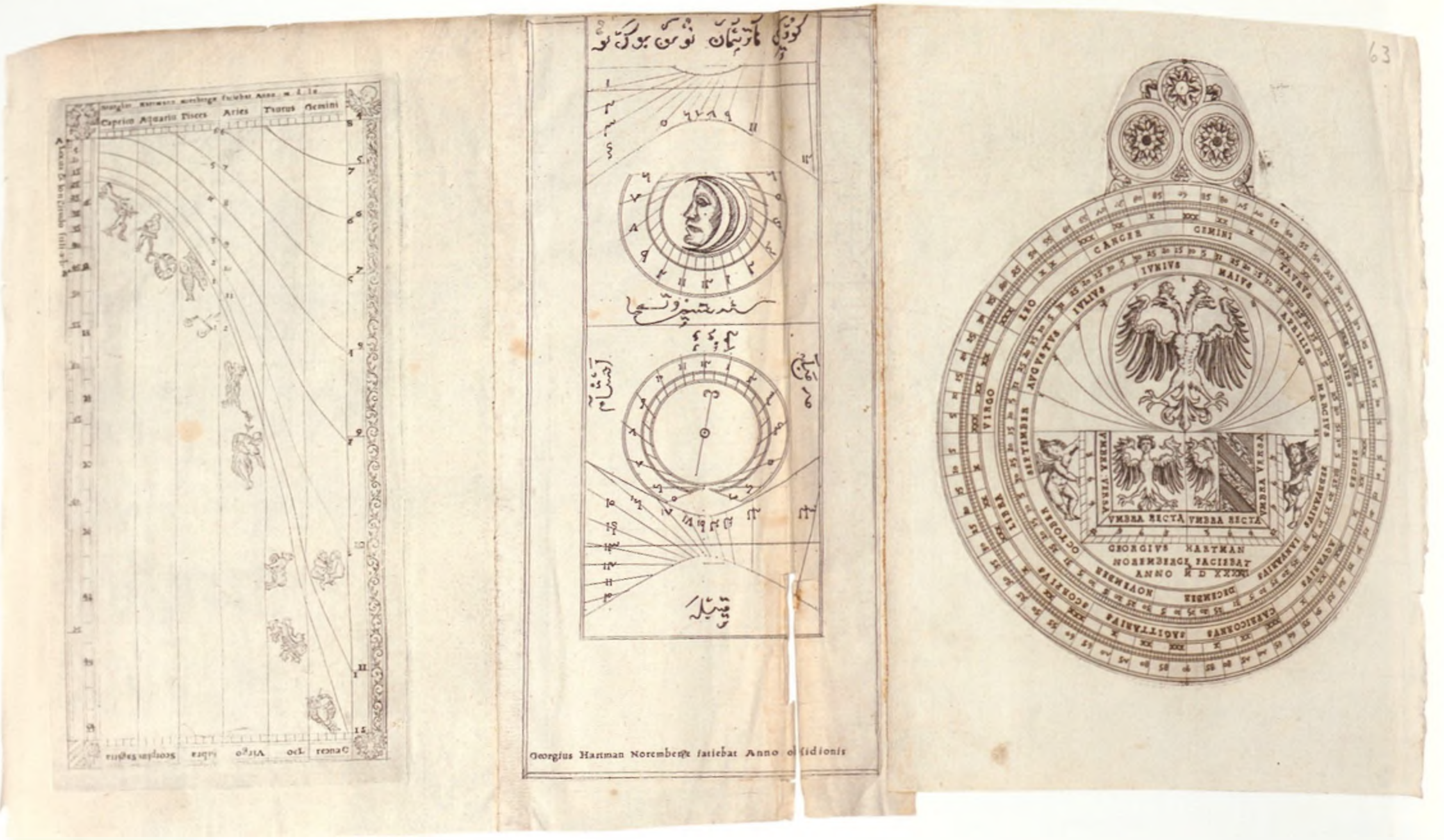
While portable time-telling devices made with printed components were perhaps the most widely used printed instruments in the early modern era, they are now the rarest. Like fifteenth-century devotional imagery, they more commonly survive as uncut sheets pasted into albums or bound into the manuals with which they were issued. Maps of the heavens and earth were one of the first printed instruments to be turned into three-dimensional objects—as globes. These began as functional two-dimensional diagrams to cut out in elongated globe-gore strips that could be pasted onto spheres. While Dürer's northern and southern *Celestial Maps* of 1515 (figs. 64–65) were not meant to be mounted in this way, they were copied hundreds of times for this purpose. Produced as a presentation gift along with a view of the terrestrial globe for one of the humanist advisors to Emperor Maximilian, the dual view depicts the heavens as if the viewer were observing them from space. Dürer's hometown of Nuremberg continued to be a major center of printmaking and scientific instrument production, and he was well aware of Regiomontanus's legacy. While Dürer did not produce printed instruments himself, other than the *Celestial Maps*, his workshop designed several for the emperor and his advisors in 1512 and 1515 as part of this campaign of mathematical and astronomical inquiry. Several were based on the Regiomontanus design, and function as sundials that also provide astrological information.

The most important printed sundial maker of the Renaissance was Dürer's colleague Georg Hartmann.[6] From 1526 until his death in 1564, he single-handedly designed and engraved or had cut as woodblocks over seventy-five sundials, astrolabes, quadrants, and other instruments (see fig. 66). Hartmann's own workshop produced folding sundials in ivory and other materials as well, and he may have enjoyed an uneasy collaboration with the Nuremberg sundial maker association (of which he was never a member). However, legislation shortly after his death outlawing "paper dials" suggests his idea of mass-producing these devices for individuals to construct (or to offer them preconstructed, still at a significantly lower cost than ivory or brass) had taken off. A haphazardly pasted album in Munich of impressions from Hartmann's workshop includes a page with two types of sundials and an astrolabe. The column dial from 1555, which features images of the zodiac as functional decoration, would have been rolled around a rod and used upright. The folding diptych


Imagines coeli Meridionales.
Reuerendiss. domino & illustriss. Principi domino Matheo sacrosancte Romane ecclesie S. Angeli Diacono Cardinali &c. Saltzpurgen. Metropolis coadiutori. Sac. Caes. Mt. per Italiam locumtenenti generali domino obseruandissimo colendissimoq. dedicatum.
Cetus
Eridanus
Orion
Canis minor
Canis maior
Lepus
Pisces Notius
Hydra
Argonavis
Ara
Corona meridionalis
Crater
Corvus
Centaurus
Fera
Ioann. Stabius ordinauit
Conradus Heinfogel stellas posuit
Albertus Durer imaginibus circumscripsit
1515

65. Albrecht Dürer (German, 1471–1528). *Celestial Map of the Southern Sky (Imagines coeli meridionalis),* 1515.

Woodcut on ivory laid paper; image: 431 x 433 mm (17 x 17 1/16 in.); sheet: 585 x 463 mm (23 1/16 x 18 1/4 in.). Kate S. Buckingham Fund, 1964.1064.



66. Georg Hartmann (German, 1489–1564). Workshop album page with three scientific instrument engravings pasted together: *Cylinder Sundial*, 1555; *Turkish Sundial*, 1529; and *Astrolabe* (verso), 1542.

Engraving on ivory laid paper, pasted together; 217 x 309 mm (8 9/16 x 12 3/16 in.) (approx.). Bavarian State Library, Rar. 434, f. 63 (not in exhibition).

dial in the center from 1529, the moment when the Turks unsuccessfully besieged Vienna, was calibrated for Constantinople and decorated with a crescent moon and Hartmann's name in a pseudo-Arabic script. The back plate from his engraved astrolabe kit offers a nearly exact copy in paper of his celebrated brass devices. These multipurpose instruments depicted the entire heavens on a flat plane and allowed the viewer to tell time, navigate, or even cast horoscopes.

Following in Hartmann's footsteps, one of the most prolific instrument makers of the seventeenth century, Charles Bloud, produced a particularly recognizable type of sundial compendium in Dieppe, France, between 1660 and 1680 (see fig. 68). This was an overloaded diptych dial with a printed compass rose inserted into an ivory body, outfitted with brass and pewter fittings. The Art Institute's example is signed *Fait & Invente par Charles Bloud A Dieppe* on a brass calendar dial on the outside, which is matched on the interior with a turning brass volvelle that served as a lunar dial, ostensibly allowing the user to tell time at night. This dial is missing the string gnomon from its interior, but like the later J. Kleininger folding pocket dial also in the museum's collection (fig. 67), a thread would have been attached to both panels at the base of the compass and at the top, where there are indentations. Hartmann was already printing separate compass designs in the mid-sixteenth century, and anonymous sheets of up to twenty-two roses in various sizes are also known from the seventeenth.[7] Most, however, were likely commissioned for particular workshops. A fleur-de-lis positioned at North at the top of this compass dial adds a bit of French panache, and the print (or one very like it) is colored in at least one surviving impression.[8] On Bloud's dial, the latitudes and city names appear within the printed rose, rather than on a separate sheet at the back as they do on the Kleininger dial. Given that the list includes fourteen cities, printing the dials (rather than engraving them in metal) likely represented a significant savings of time and money.[9] Both the seventeenth-century

Bloud sundial compendium and Kleininger sundials from the late eighteenth century were intended for peripatetic travel, exactly like their predecessors in the sixteenth century.

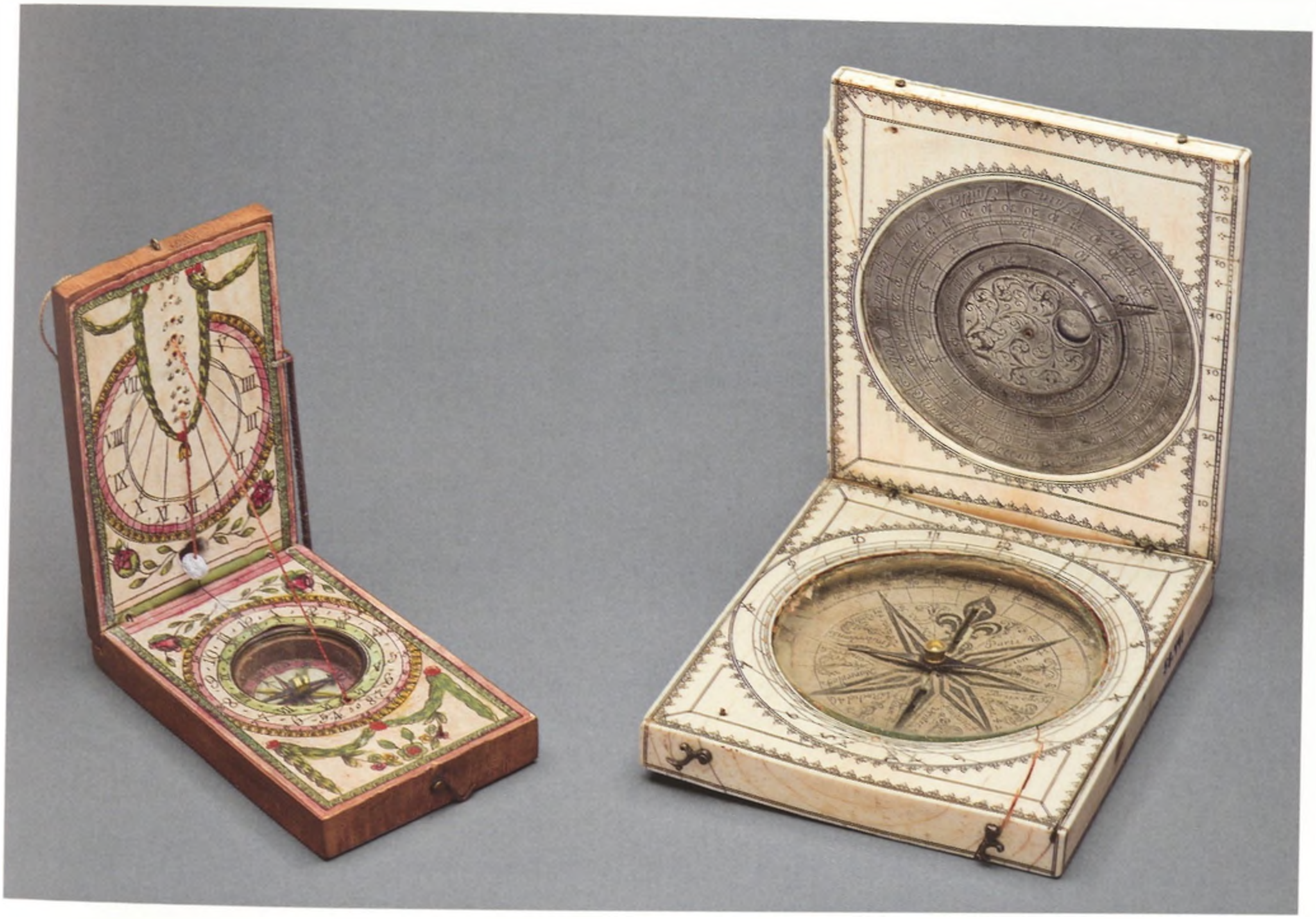
By the eighteenth century, Nuremberg was still the hub of pocket sundial production, by then spearheaded by the much-copied Daniel Beringer (active 1777–1821). His workshop turned out hundreds of preconstructed fruitwood sundials with hand-colored printed paper faces in both the standard folding shape and the more ostentatious cube angled on a mount with up to five simultaneous working faces.[10] The Chicago diptych sundial, with an etched and colored paper veneer on wood in the Beringer style signed by Kleininger, was probably made around 1790 (fig. 67). It includes a traditional list of cities and their latitudes on the verso, for 38 (Washington, D.C.) to 56 (Riga). The device is pictured with a setting for 50 degrees (Kraków). This is, however, slightly misleading, for of the twenty-two cities listed on the etching, the dial itself has holes for thread to reset the latitude from 56 to 40 (but not 39 or 38, the latitudes of two of the American cities—Washington and Baltimore). This omission reinforces the idea that the dial dates after 1790, as Washington only became the capital of the United States on July 16 of that year and would not otherwise have merited inclusion. The fact that the names of the European cities and the directions on the compass are in German suggest an additional

67. J. Kleininger (German, late 18th century–19th century). *Portable Compass Sundial*, c. 1790. (left)

Wood, hand-colored etching on paper, and glass with string gnomon; 87 x 52 mm (3 7/16 x 2 1/16 in.). Gift from Mr. Charles H. Morse, Sr., in memory of his wife, Mrs. Charlotte Morse, 1958.440.

68. Charles Bloud (French, mid- to late-17th century). *Portable Diptych with Compass, Sundial, and Perpetual Calendar*, 1660/80. (right)

Ivory, brass, glass, etching on ivory laid paper used for compass rose; 105 x 89 x 16 mm (4⅛ x 3½ x ⅝ in.). Gift from Mr. Charles H. Morse, Sr., in memory of his wife, Mrs. Charlotte Morse, 1958.441.

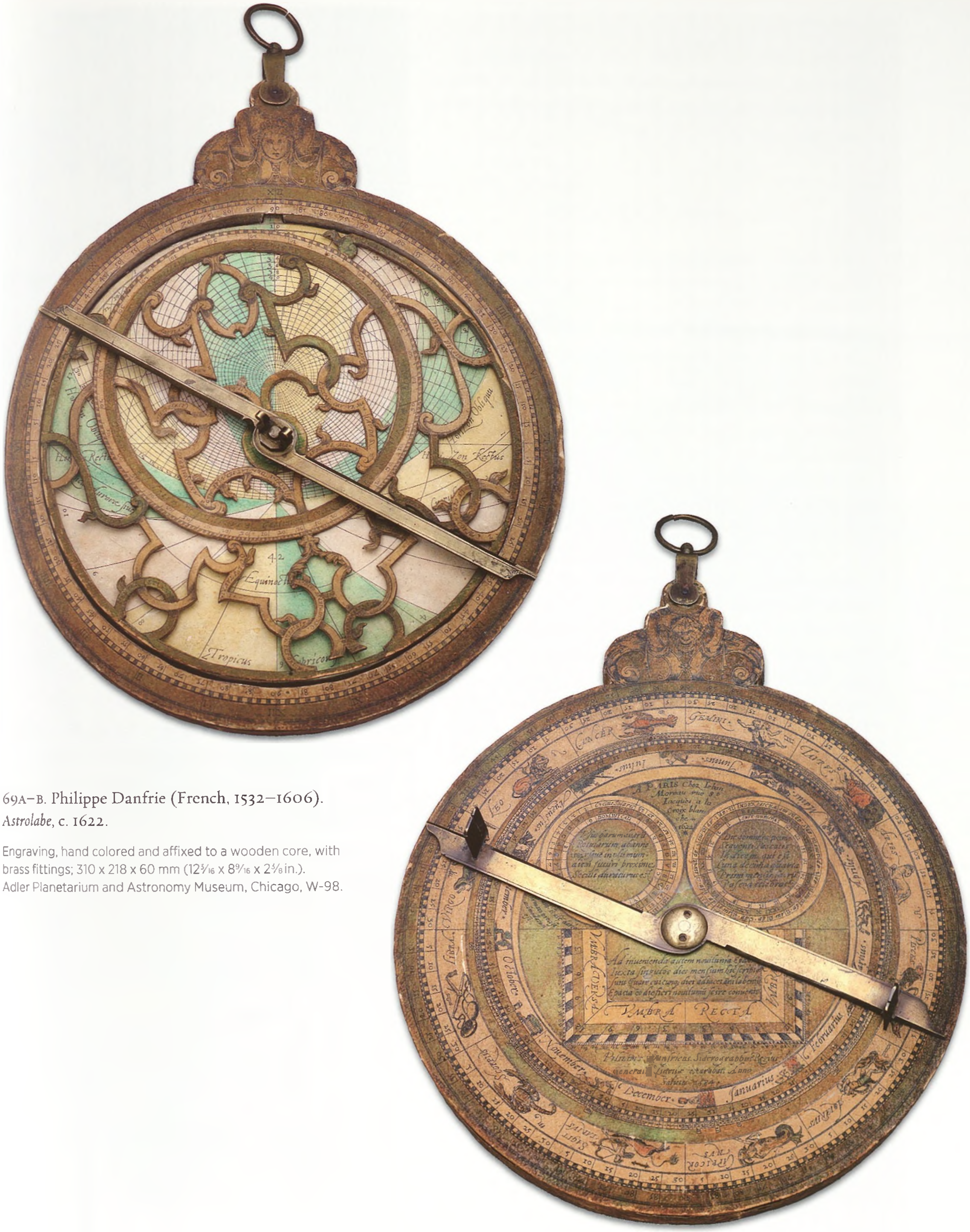


explanation for this cost-saving measure—the intention to market it in Europe rather than the New World. By contrast, Hartmann's 1529 engraved sundial for the Turkish market was valid only in Constantinople, but it could easily have served as a curiosity within Europe at the same time.

Hartmann may have been the first to market printed astrolabes, the engraved back plate of one of which is also in the Munich album (fig. 66). These multipurpose devices were usually cast in brass and used the stars to tell time, navigate, and cast horoscopes, among other functions. Hartmann's astrolabe underwent at least two printings, in 1535 and, as in this updated state, in 1542.[11] The medium of copper engraving made these corrections so easy that another German astrolabe printer, Johannes Krabbe, updated his own set of plates with issues in 1583 and 1609, before they went into posthumous editions in 1625 and 1630. Two complete impressions of the set are still unmounted in their manuals in Wolfenbüttel, where Krabbe was court mathematician. Another direct descendant of Hartmann's printed instruments, the paper astrolabe by Parisian Royal Mint operator Philippe Danfrie, went into at least three editions in 1578, 1584, and 1622 (see figs. 69A–B). He sold out his 1578 stock and updated the 1584 edition for the change to the Gregorian calendar, solving a problem Regiomontanus had been called to Rome to master when he died. The posthumous edition in 1622 also included revised star positions, after which the nine copper plates disappeared.[12] Danfrie's astrolabe is thus one of the best-known paper instruments from the turn of the seventeenth century, despite the relative lack of an instrument industry in France outside of the Dieppe region until some sixty years later.

The Adler Planetarium owns an assembled example of the 1622 reprinting (figs. 69A–B). Other constructed impressions are at the Paris Water Authority and in private hands (1578), Oxford (1584), and the National Museum of American History (1622). No unmounted impressions of the engravings are known to have survived on their own or folded into the 1625 manual for the astrolabe. The Adler's is the only colored example, in muted green, brown, and reddish watercolor, and, likely, varnish. The figures of the zodiac on the verso (fig. 69B) were given particular attention, with each instance of flame colored red. The Oxford example is the closest to the Adler's astrolabe in terms of construction, for some care has been taken in sculpting the headpiece around the curves of the allegorical head and swags on each side—a serene female countenance on the front, and a wry, shaggy Wildman or monkey with a headband emphasizing his pointy ears on the back. The Oxford astrolabe, from the 1584 edition, survived in surprisingly good condition with the help of a custom leather case, possibly made by Danfrie himself, who is known to have had a secondary career as a maker of bookbinding tools.[13] The case suggests that the instrument was considered valuable enough to protect, even though it was predominantly made of wood, pasteboard, and paper, rather than solely of brass. Perhaps Danfrie constructed it, too. The posthumous Adler astrolabe is comparatively well preserved, with care taken in excising the board around the tendrils of the rotating net through which the sky map appropriate to each latitude could be seen. These interchangeable plates under the net are colored in similar tones to the verso, in wide bands of yellow, green, and rose watercolor that differentiate the calculation areas. The rotating star map and the ring into which it is set are rendered a darker brownish green, again possibly to mimic the sheen of the device's customary brass. Like the earlier Oxford example, the Adler astrolabe is outfitted with rudimentary brass fittings, notably the suspension crown and the rotating alidade bar on the back (used for measuring angles and altitudes), suggesting that the prints came with a diagram showing how to design the accessories, as did Hartmann's astrolabe kits.

Jean Moreau, who reprinted the 1622 engravings seen on the Adler's Danfrie astrolabe, extolled the benefits of paper instruments.[14] Not only did he acquire the Danfrie plates and update them, he wrote the 1625 manual explaining how to use the astrolabe and sought out other instrument plates as well, for the purpose of making them more widely available at a time when metal devices were cumbersome, expensive, and rarely consulted—the same problems that led Hartmann to make sundials and astrolabes on paper available a century earlier. As Moreau explained, "Dear Reader, having recognized the curiosity of many persons . . . to seek a great number of various mathematical instruments . . . I have been able to find engraved plates of various mathematical instrument



69A–B. Philippe Danfrie (French, 1532–1606). *Astrolabe*, c. 1622.

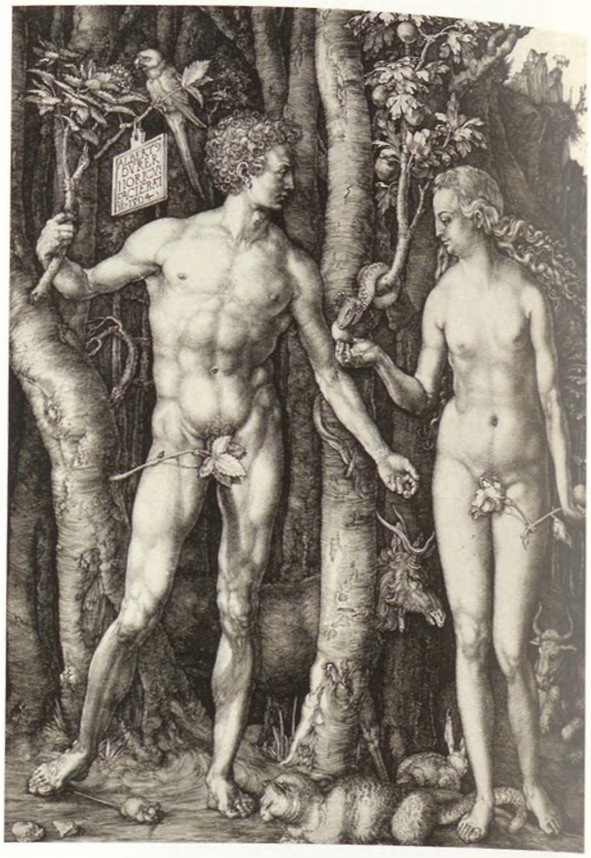
Engraving, hand colored and affixed to a wooden core, with brass fittings; 310 x 218 x 60 mm (12 3/16 x 8 9/16 x 2 3/8 in.). Adler Planetarium and Astronomy Museum, Chicago, W-98.

designs such as the astrolabe, cylinder, radiometer, graphometer, trigonometer, clocks, and others, at last so having had printed a large number of impressions, each instrument can be available to all."[15]

Anatomy Flap Prints

The Danfrie astrolabe plates are not the only Renaissance-era printed instruments with an active afterlife. The Art Institute possesses rare first-state impressions of a trio of engraved, etched, and letterpress-printed anatomical broadsheets by the Augsburg artist Lucas Kilian from 1613 (figs. 61, 71–75).[16] Together, these sheets boast over a hundred superimposed organ flaps allowing the viewer to dissect male and female corpses, whether as a didactic medical exercise or purely out of morbid curiosity. Perhaps uniquely for flap prints of this era, eighteenth-century restrikes of the plates for the second state of 1619 are known, which show exactly how Kilian imposed the interior flaps for printing (figs. 76–78). Yet even the 1754 reprinting lacks instructions on how to build the mannequins from their astonishingly tightly organized components. Each constructed impression has survived in a slightly different arrangement and bears signs of viewer interaction with its flaps. These sheets elicited strong reactions due to their heady mix of allegorical iconography and Vesalian anatomy, made ever more potent by their removable organs and naked flesh.

In contrast to Hartmann's printed sundials, which mainly survive in unused sheets, the 1613 Kilian anatomy flap prints must have been purchased preassembled from their publisher. Despite the thorough indexing of body parts with capital letters in descending order as the flaps move deeper into the body, there are not enough tabs or other visual cues for a purchaser to have put them together himself. The main engravings were pasted down onto a second sheet with the letterpress title *Mirrors of the Microcosm (Catoptri Microcosmici)* and filigreed woodcut borders. The set consisted of three sheets, each subtitled a *Vision (Visio)* of the human body. The first shows a male and a female figure after Dürer's 1504 engraving of *Adam and Eve* (fig. 70).[17] They stand on plinths flanking a large truncated (and pregnant) female torso covered by a Medusa-head flap (here lacking both the Medusa and the fetus flap), underneath a cloud of angels in glory circling a flap roundel labeled *Yahweh* in Hebrew letters (see fig. 71). Schematic eye and ear flaps appear to the upper left and right, and a heart can be seen in the center. Each of these figures contains as many as seven flaps that open out of the main sheet. The second and third *Visions* show larger-scale images of Adam and Eve respectively, each standing on a skull with its own flaps (figs. 72, 74). Adam demonstrates the workings of the heart on the left side, and Eve the lungs on the right. Each figure sports flaps of billowing cloth offering



70. Albrecht Durer (German, 1471–1528). *Adam and Eve*, 1504.

Engraving on ivory laid paper; image: 250 x 193 mm (9⅞ x 7⅝ in.); sheet: 253 x 196 mm (10 x 7¾ in.). Clarence Buckingham Collection, 1944.614.

71. Lucas Kilian (German, 1579–1637). *First Vision (Visio Prima)* (Adam and Eve) from *Mirrors of the Microcosm (Catoptri Microcosmici)*, 1613.

Broadsheet engraving on ivory laid paper, discolored to buff, cut, with etching on ivory laid paper components, laid down on letterpress printed ivory laid paper, and mounted on cream wove paper; engraved sheet: 359 x 265 mm (14⅛ x 10 7/16 in.); letterpress-printed secondary support: 510 x 340 mm (10 1/16 x 13⅜ in.). Gift of Dr. Ira Frank, 1944.521

CATOPTRI MICROCOSMICI

Viſio prima,

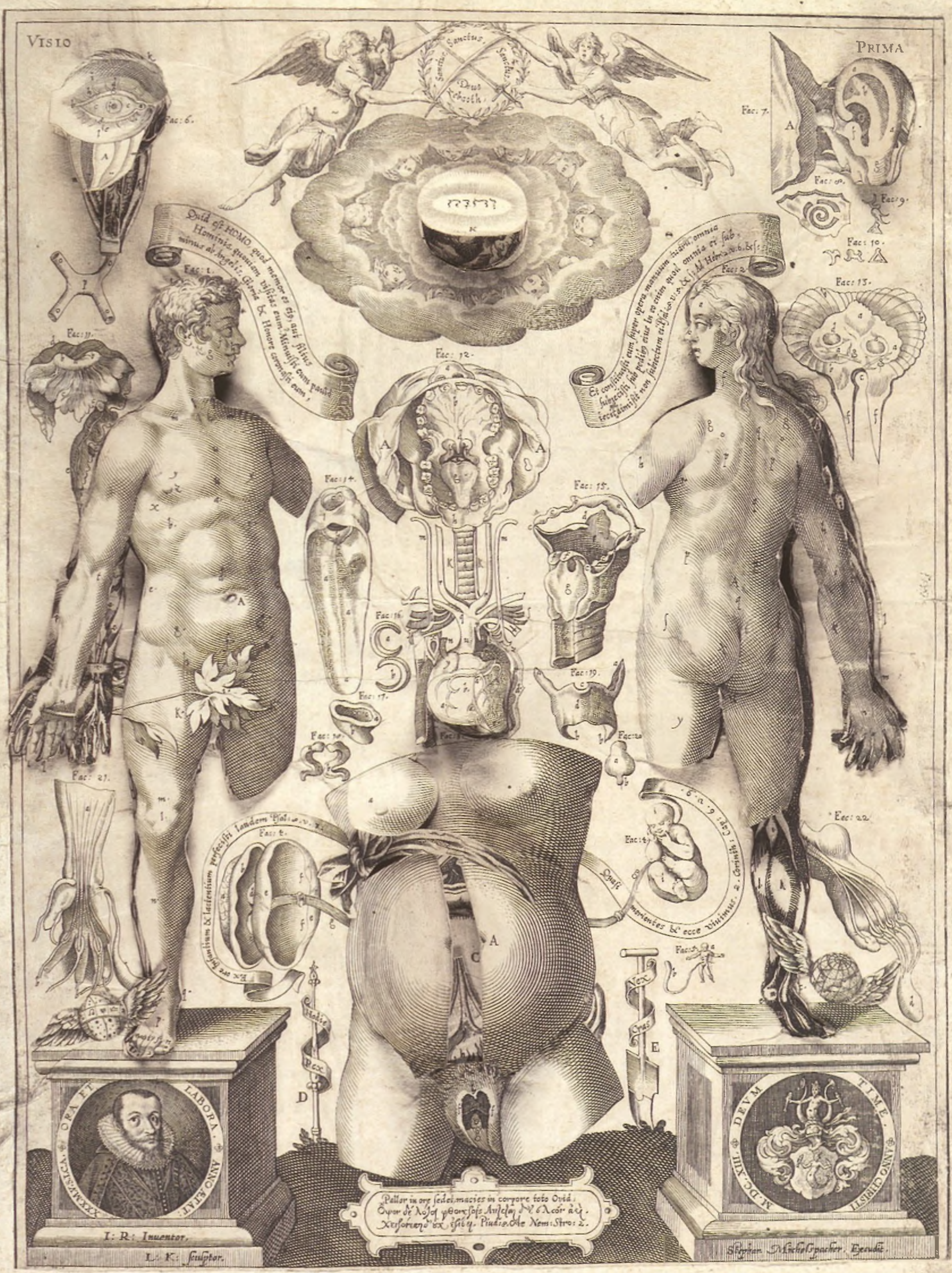
ABSOLUTAM ADMIRANDÆ PARTIUM HOMINIS CREATURARUM DIVINARUM PRÆSTANTISSIMI FABRICÆ EXIMIO ARTIFICIO SCULPTAM STRUCTURAM

ſpectandam & revidendam exhibentis,

CVM ENARRATIONE HISTORICA BREVI AT PERSPICUA ET

Explicationis & Indicis vice addita.

Trin-uni Deo, Patri, Filio, & Spiritui, Sancto, cujus è ſinu profluxit, ſacrum.


VISIO
PRIMA
Sanctus Sanctus Sanctus
Deus Zebaoth
Quid eſt HOMO, quod memor es ejus, aut filius Hominis, quoniam viſitas eum? Minuiſti eum paulò minus ab Angelis, Gloria & Honore coronaſti eum,
Et conſtituiſti eum ſuper opera manuum tuarum, omnia ſubjeciſti ſub pedibus eius. In eo enim quod omnia ei ſubjecit, nihil dimiſit non ſubiectum ei. Pſal. 8. v. 5. & 6. Ad Hebr. 2. v. 6. & ſeq.
Fac: 1.
Fac: 2.
Quaſi morientes & ecce vivimus. 2. Corinth. 6. v. 9.
Fac: 6.
Fac: 7.
Fac: 9.
Fac: 10.
Fac: 11.
Fac: 12.
Fac: 13.
Fac: 14.
Fac: 15.
Fac: 16.
Fac: 17.
Fac: 19.
Fac: 21.
Fac: 22.
A
C
D
E
Hodie
Rex
Nox
Cras
ORA ET LABORA
DEUM TIME
M. DC. XIII.
ANNO CHRISTI
I: R: Inuentor.
L: K: ſculptor.
Stephan Michelſpacher. Excudit.
Pallor in ore ſedet, macies in corpore toto Ovid.

GENERIS HVMANI

GEMITVS.

O Deus ante chaos ante omnia corpora rerum,
Solus qui finem non habiture manes.

Clara levi terra Divinæ Mentis Jmago
Gignitur, immenſa de bonitate tua:
Attamen à ſtulta præſtans mox Conjuge Conjunx
Inducta captus Dæmonis arte mali.

Præceptum ecce tuum Divinum negligit, atque
Damnoſum damnum flebilis uſque capit.
Blando ſcilicet illuſus ſermone Colubri
Humanum perdis primus Adame Genus.

Pallida cauſas ut vacuum Mors intret in orbem
Invito commedens triſtia poma Deo.
Gramen Vita fit ut fugiens noſtra efficis, Ignis
Fumus, quæ ſubitò deperière vices.

MEDI-

CATOPTRI MICROCOSMICI

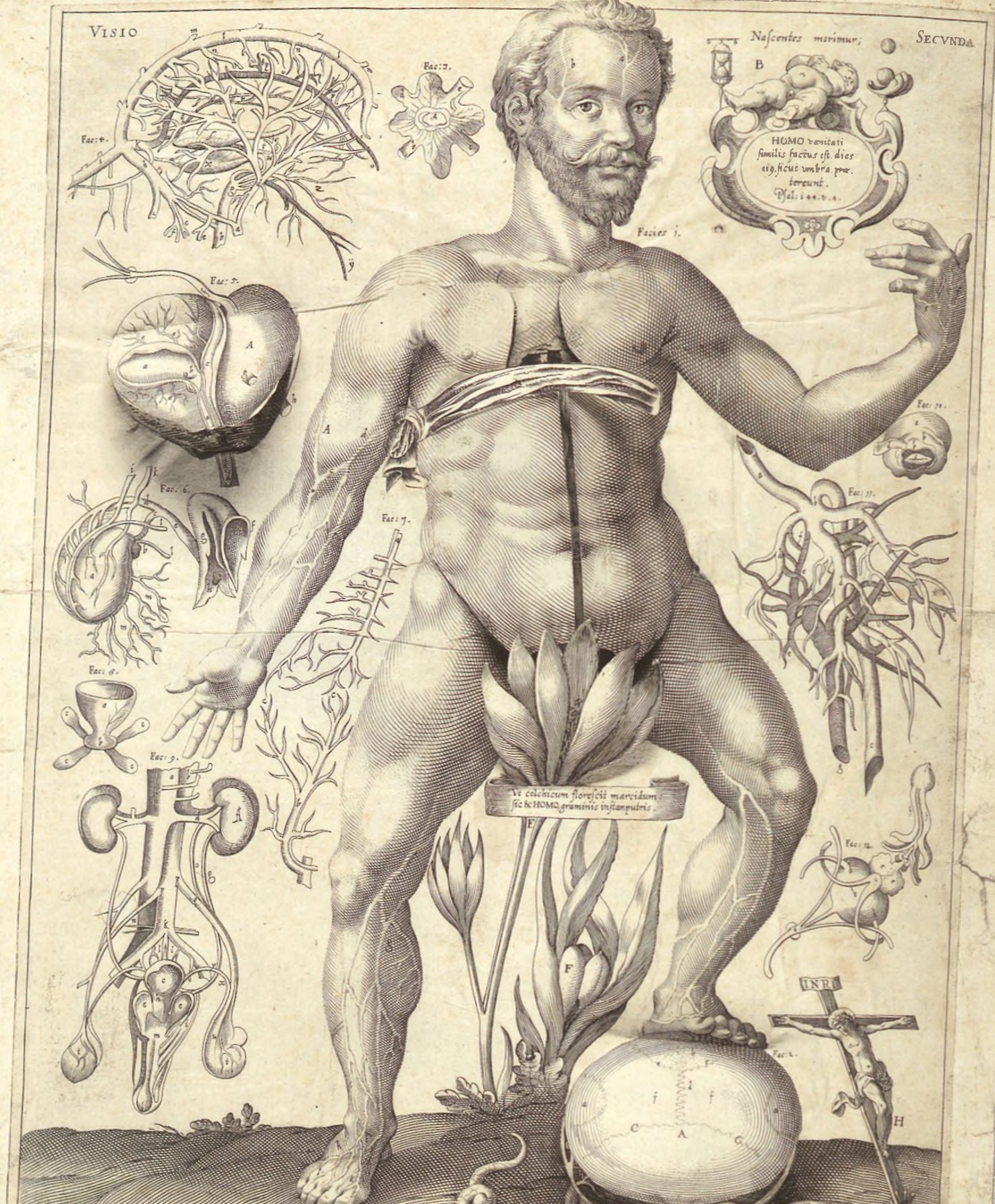
Viſio ſecunda,

ABSOLUTAM ADMIRANDÆ PARTIUM HOMINIS CREATURARUM DIVINARUM PRÆSTANTISSIMI FABRICÆ EXIMIO ARTIFICIO SCULPTAM STRUCTURAM

ſpectandam & revidendam exhibentis,

CVM ENARRATIONE HISTORICA BREVI AT PERSPICUA ET Explicationis & Indicis vice addita.

Trin-uni Deo. Patri. Filio. & Spiritui. Sancto. cuius è ſinu profluxit. ſacrum.


VISIO
SECVNDA
Naſcentes morimur;
B
HOMO vanitati ſimilis factus eſt. dies eiꝰ ſicut umbra præ- tereunt.
Pſal: 144. v. 4.
Facies 1.
Fac: 2.
Ut colchicum floreſcit marcidum: ſic & HOMO graminis inſtar putris.
E
F
C
A
H
INRI

MEDIATORIS CHRISTI
SOLATIUM.
Non tulit at ſuperi Proles manſueta Tonantis
Ah æterni iram damna ſuprema Dei;

Sed nudo miſero fugitivo dicit Adamo;
Sume animum, noſtra pectora fige fide.
Ecce miſer pauper venio, ut mea copia ditet,
Imponens tergo crimina cuncta meo.

In cruce qui pro te mulctatus morte pependi,
Exto, devicta nunc nece, vita tibi.
Suſpice, deijciat nec deſperatio mentem,
Horreo non hominis ſumere membra Deus.

Reſpice, mortua flore ut Colchidos herba vireſcit,
Propria avis Phœnix naſcitur & cinere;
Sic Homo morte mea vives feliciter, atque
Floridus æternùm conſpiciendus eris.

HO.

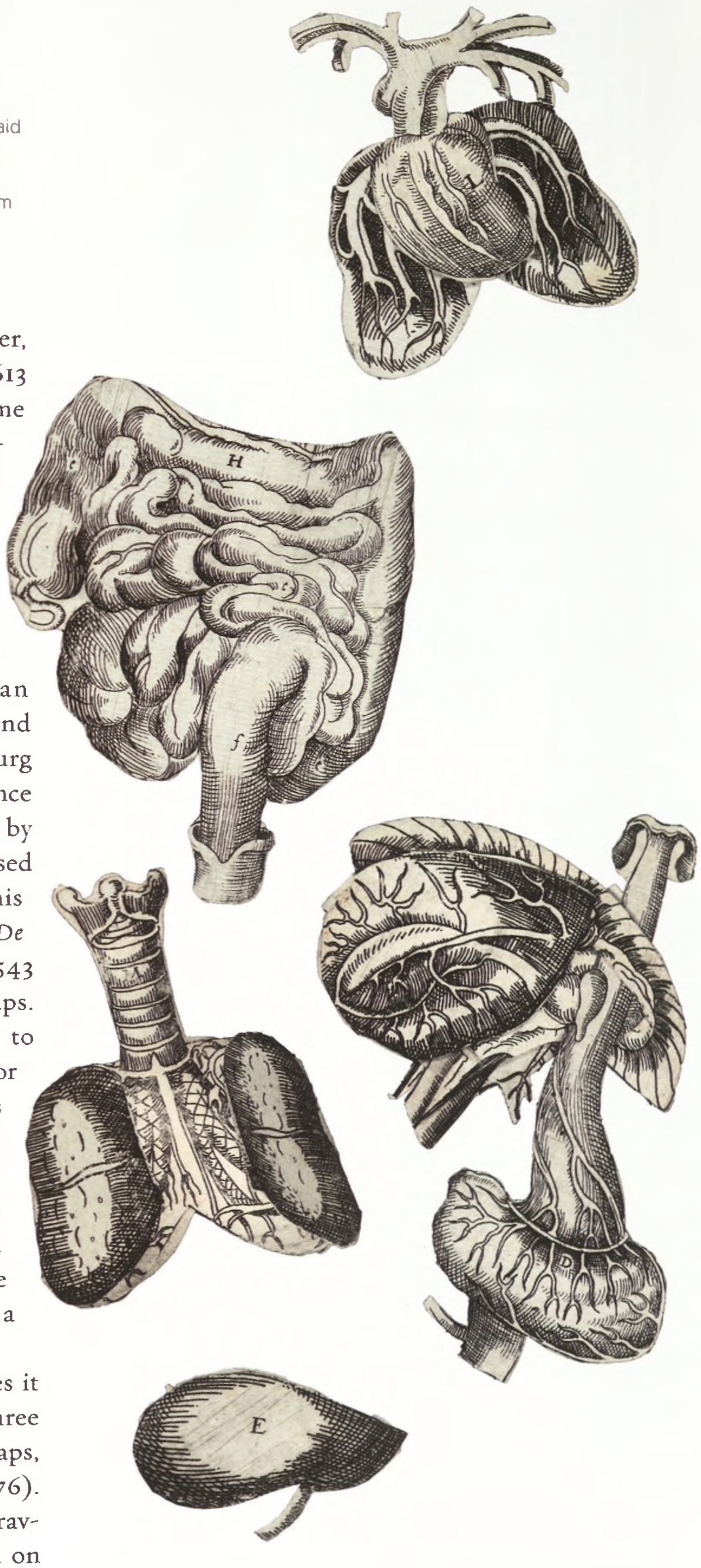
72. Lucas Kilian (German, 1579–1637). *Second Vision (Visio Secunda)* (Adam) from *Mirrors of the Microcosm (Catoptri Microcosmici)*, 1613.

Broadsheet engraving on ivory laid paper, cut, with etching on ivory laid paper components, laid down on letterpress printed ivory laid paper, and mounted on cream wove paper; engraved sheet: 359 x 265 mm (14⅛ x 10 7/16 in.); letterpress printed secondary support: 508 x 340 mm (20 x 13⅜ in.). Gift of Dr. Ira Frank, 1944.461.

additional cover for the prudish or squeamish viewer, and keeping the anatomical bits in place. The 1613 broadsheets entered the Art Institute at the same time, and from the comparable level of tears, marginal dirt, and other damage appear to have always been a matched set. The three sheets even share a wormhole, suggesting they were once kept together in a large book or portfolio.

Kilian's flap broadsheets are some of the most intricate interactive prints extant. While Heinrich Vogtherr the Elder had produced an extremely popular (and much pirated) male and female pair of woodcut flap broadsides in Strasbourg in 1538 to 1539, his anatomy bore little resemblance to reality, and was almost immediately superseded by Andreas Vesalius's teachings.[18] Vesalius, in turn, used the concept of Vogtherr's superimposed flaps in his student version of *On the Fabric of the Human Body* (*De humani corporis fabrica*); the *Summary (Epitome)* of 1543 recommended vellum strips to reinforce the flaps. Kilian's anatomy owes more to Vesalius than to Vogtherr, and he (perhaps with the aid of the author of the text, Johann Remmelin) developed his own novel means of attaching the organs. In fact, the sheets were already being used in the Leiden University anatomy theater by 1618. In 1598, its founder, Paulus Pauw, framed and pasted onto a board "40 prints after Vesalius" for the walls of the theater, and the flap broadsides were likely used in a similar didactic manner.[19]

From the uncut impressions of Kilian's plates it becomes clear that the top sheet of each of the three broadsides incorporated the upper level of the flaps, most of which show the figures' skin (see fig. 76). Watermark evidence confirms that the main engravings of the Chicago impressions are all printed on the same paper type.[20] These were then partially cut out to reveal the cavities below, leaving hinges on



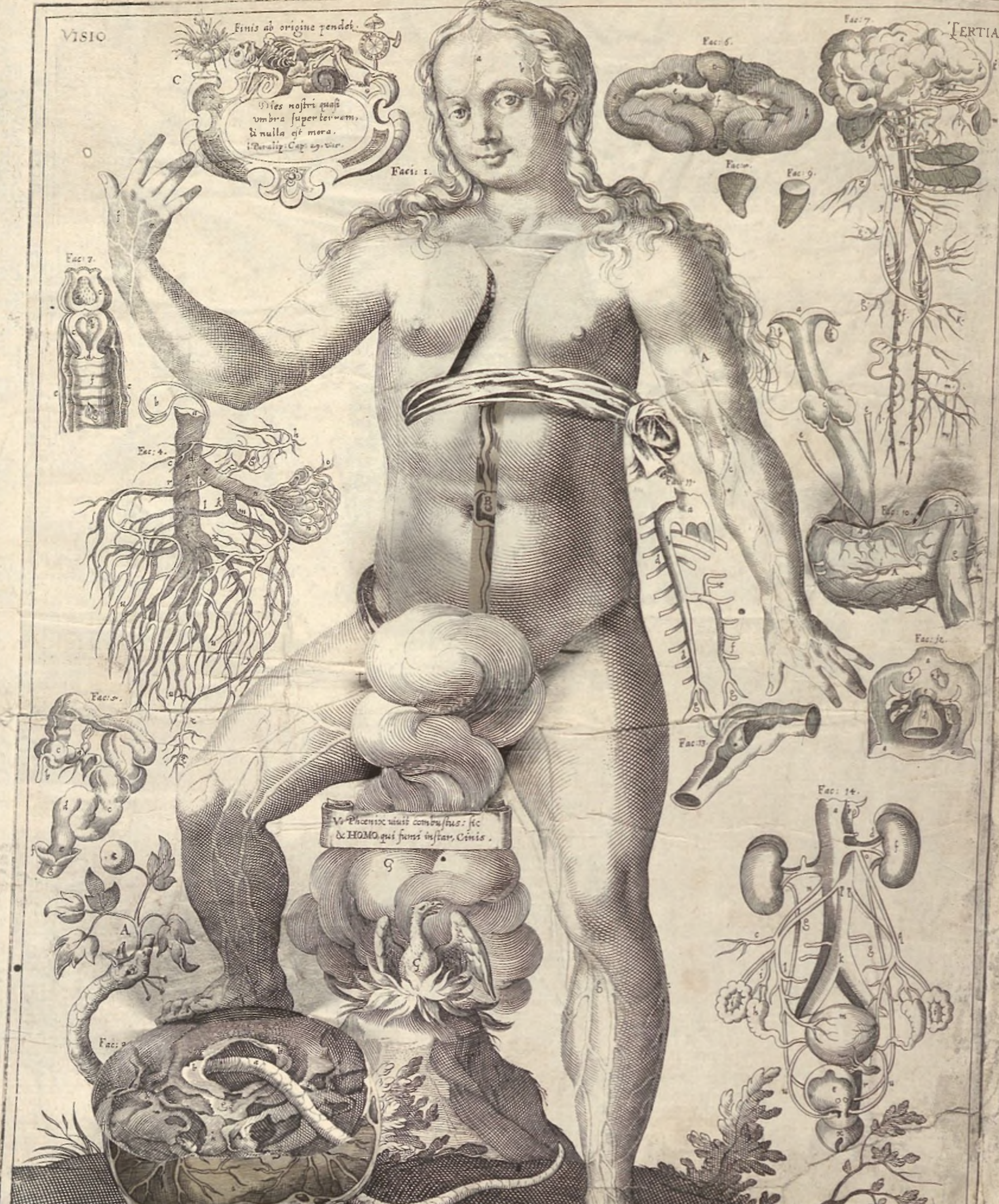
73. Removable organs, from the *Second Vision* and *Third Vision* from *Mirrors of the Microcosm (Catoptri Microcosmici)* (figs. 72, 74).

CATOPTRI MICROCOSMICI
Viſio tertia,

ABSOLUTAM ADMIRANDÆ PARTIUM HOMINIS CREATURARUM DIVINARUM PRÆSTANTISSIMI FABRICÆ EXIMIO ARTIFICIO SCULPTAM STRUCTURAM

ſpectandam & revidendam exhibentis,
CVM ENARRATIONE HISTORICA BREVI AT PERSPICUA ET
Explicationis & Indicis vice addita.

Trin-uni Deo, Patri, Filio, & Spiritui, Sancto, cujus è ſinu profluxit, ſacrum.



HOMINIS ERGA DEUM GRATES.

Vive & vere Deus celſi moderator Olympi
Laus tibi pro meritis ſit ſine fine tuis.

Inter ſpurcæ urinæ humentes atq; meatus,
Fœtida tum circum ſtercora natus Homo.
Et miſeras genetrix quem flens effudit in auras,
Quiq; ſuum cœpit principium à lachrymis.

Seſe poſſe negat meritas tibi reddere grates,
Grates quas igitur poterit, ecce dabit;
Semper honor tuus ore ſuo laudesq; ſonabunt
Ipſi, quo æthereus ſpiritus oſſa reget

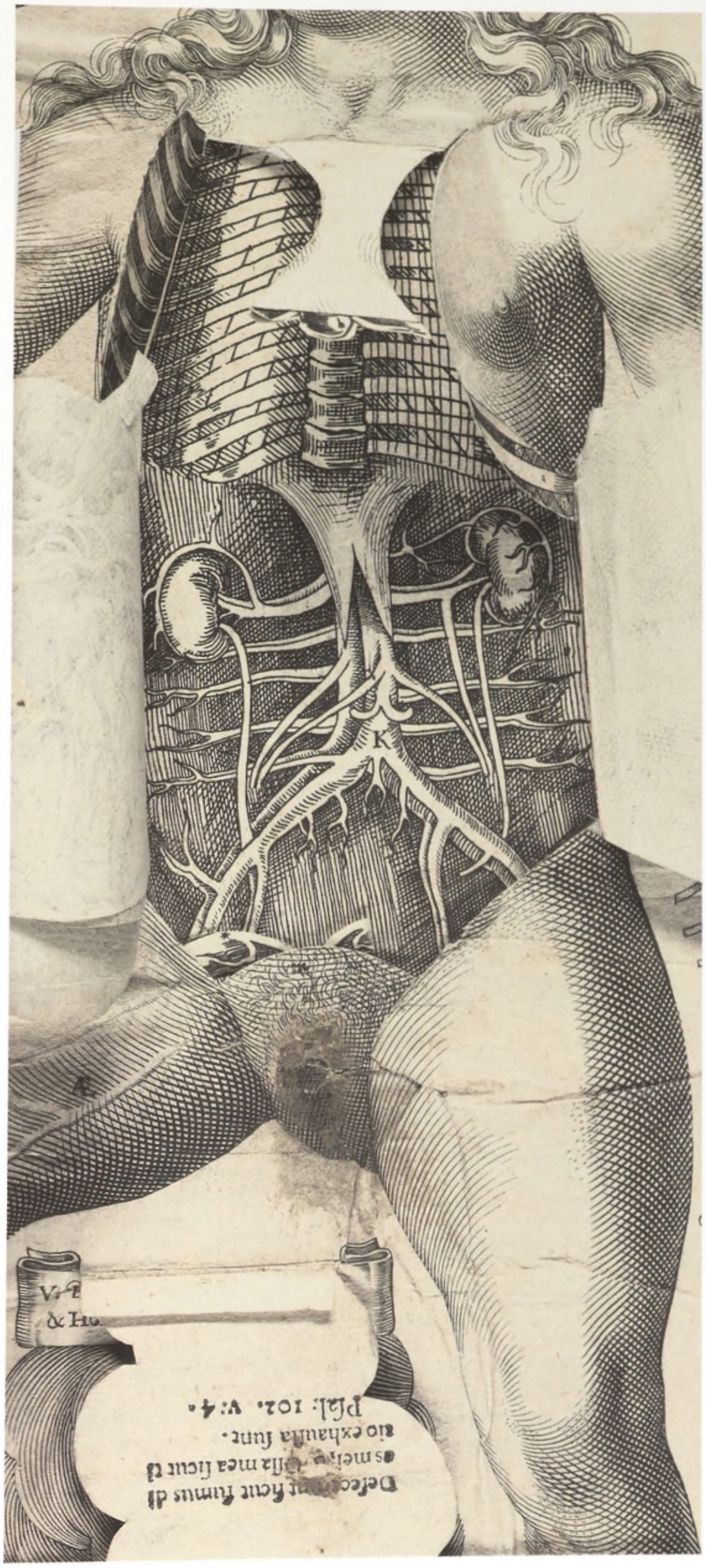
Cætu cum ſancto ſancto modulamine cantans
Æternum grates, mente hilari reſonans;
O Sanctus Zebaoth, Sanctus, Sanctiſſime, ſemp
Qui Pater omnipotens & ſine fine Deus.

74. Lucas Kilian (German, 1579–1637). *Third Vision (Visio Tertia)* (Eve) from *Mirrors of the Microcosm (Catoptri Microcosmici)*, 1613.

Broadsheet engraving on ivory laid paper, discolored to cream, cut, with etching on ivory laid paper components, laid down on letterpress printed ivory laid paper, and mounted on cream wove paper; engraved sheet: 358 x 265 mm (14 ⅛ x 10 7/16 in.); letterpress printed secondary support: 507 x 335 mm (20 x 13 3/16 in.). Gift of Dr. Ira Frank, 1944.462.

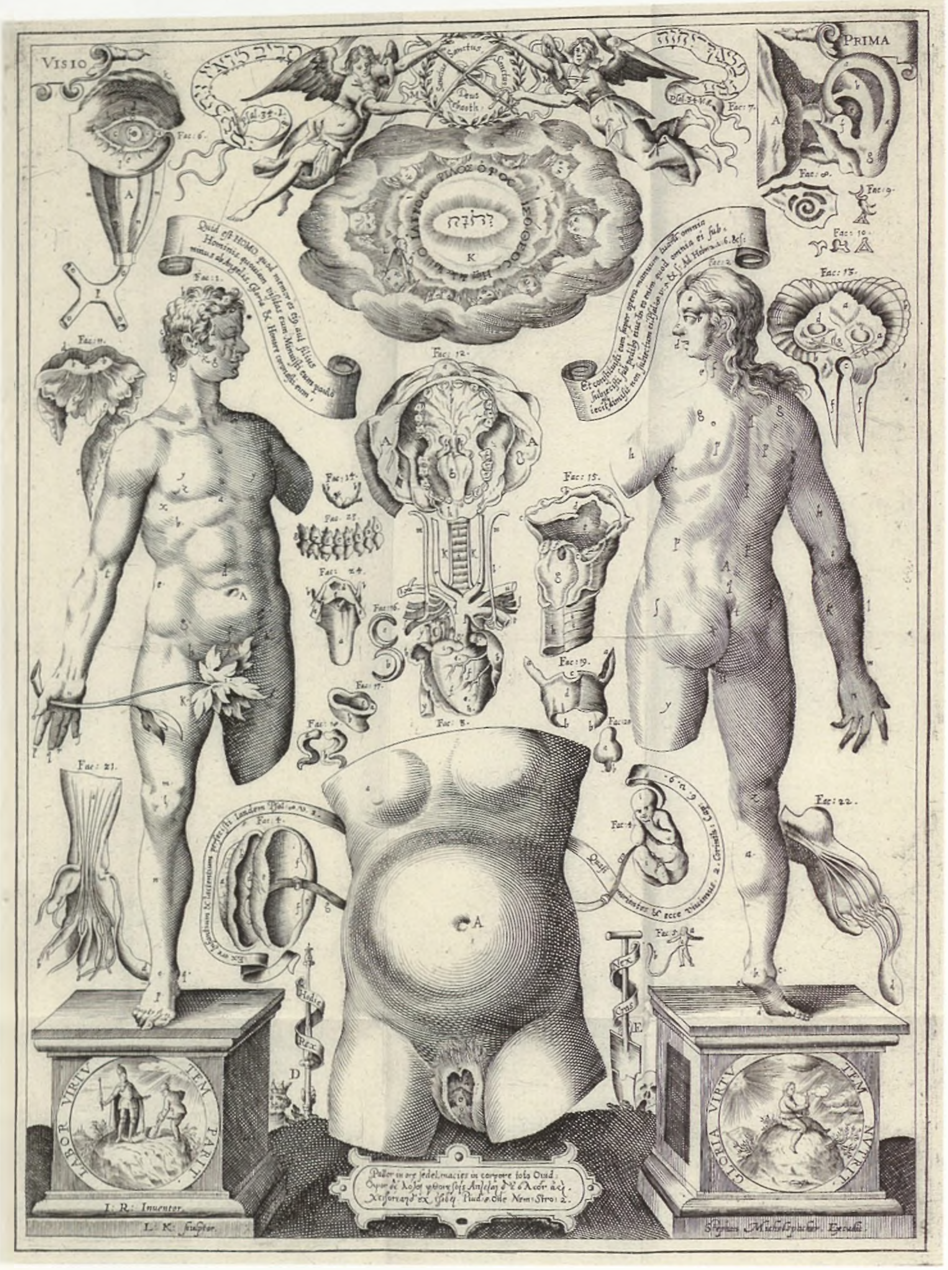
one side to keep the flaps attached to the page. The flaps and organs were, however, etched onto plates wherever they fit and printed on different, slightly thicker, paper than the main sheets. The internal organs were glued together in bundles of layers in descending order and then affixed to the verso of this main sheet. This grouping allowed the viewer to burrow ever deeper into the recesses of the human form and to lift the flaps up and out in every direction. Previous flap prints by Vogtherr and others had clumsily attached the flaps to move vertically from the neck, limiting the suggestion of interior space. In contrast, as the text accompanying the 1619 publication proves, not all of the organs were meant to be glued down. In fact, the heart and lungs were placed loosely in the chest cavity for easy removal, guaranteeing a close encounter with these important body parts. In addition, Adam and Eve's lungs are printed on both sides and spread like a triptych to reveal even deeper parts (fig. 73, organ A).[21] Many of the flaps in these sheets open horizontally. Others, including the Yahweh roundel at the top of the *First Vision*, lift upward, as do a phoenix's smoke cloud that obscures Eve's genitals and a large flower that hides Adam's. At the lower right of one of the uncut plates appear the etched layers comprising Eve's front ribs (see fig. 78). These were pasted onto the verso of the top flap; once cut out, the breastbone lifts freely upward, while Eve's breast spreads wide open, as if the viewer were ripping open her ribcage on the operating table, in three dimensions (see fig. 75).

The medical doctor Johann Remmelin, who designed the flap prints while a student, coyly denied responsibility for the 1613 edition until the single-sheet prints appeared to be selling, presumably for use as visual aids to other students. In a preface to the subsequent folio-sized book, entitled *Mirror of the Microcosm (Catoptrum Microcosmicum*; 1619), Remmelin's claim that he condescended to correct only this second edition



75. Detail of the *Third Vision (Visio Tertia)* from *Mirrors of the Microcosm (Catoptri Microcosmici)* (fig. 74), showing Eve with her chest opened and a substance added to her pubic region.

rings false, as the anatomical details of the main plates are all but unchanged, even in the 1754 restrikes (compare figs. 71 and 76). Though the layers are simplified slightly for clarity, it is on the whole the same set. The allegories become more blatant, with a king's head and a skull added to the letters *D* and *E* respectively, where there were previously only a scepter and a shovel labeled with the motto *Hodie Rex / Nex Cras* (King Today, Dead Tomorrow). Rather, Remmelin's remarks suggest an attempt to intensify interest in the new version of the flap anatomy rather than to disown the old one: "I never contemplated publication of the work, but fashioned it only for my own use . . . . but it happened that the general talk of it among my friends caused this *Catoptrum* to be wrested away from me for inspection and circulation, until, through their persuasion and at their expense, it began to be published, without my knowledge, and to be enjoyed like an unripe fruit."[22] Though there appears to be consistency in the ways different impressions of the 1613 sheets have been put together, Remmelin's "unripe fruit" would have been well nigh impossible for workshop members, let alone untutored members of the public, to construct without a drawn or printed model. None of the related manuals from 1614/15 or 1619 broach the subject either, or include a note to the bookbinder on how to proceed, eliminating the possibility outright that buyers, even the medically trained ones who likely constituted the prints' first audience, did the assembly. Even the artist, Kilian, would have needed to follow a model to design the parts at the correct scale and in the correct quantity. This model could have been drawings by Remmelin, a constructed mannequin, or both. While the Vogtherr woodcuts reuse parts between the male and female broadsheets, the repetition of these parts on the restrikes of the Kilian plates suggest there was not much streamlining for faster printing and assembly, so perhaps the

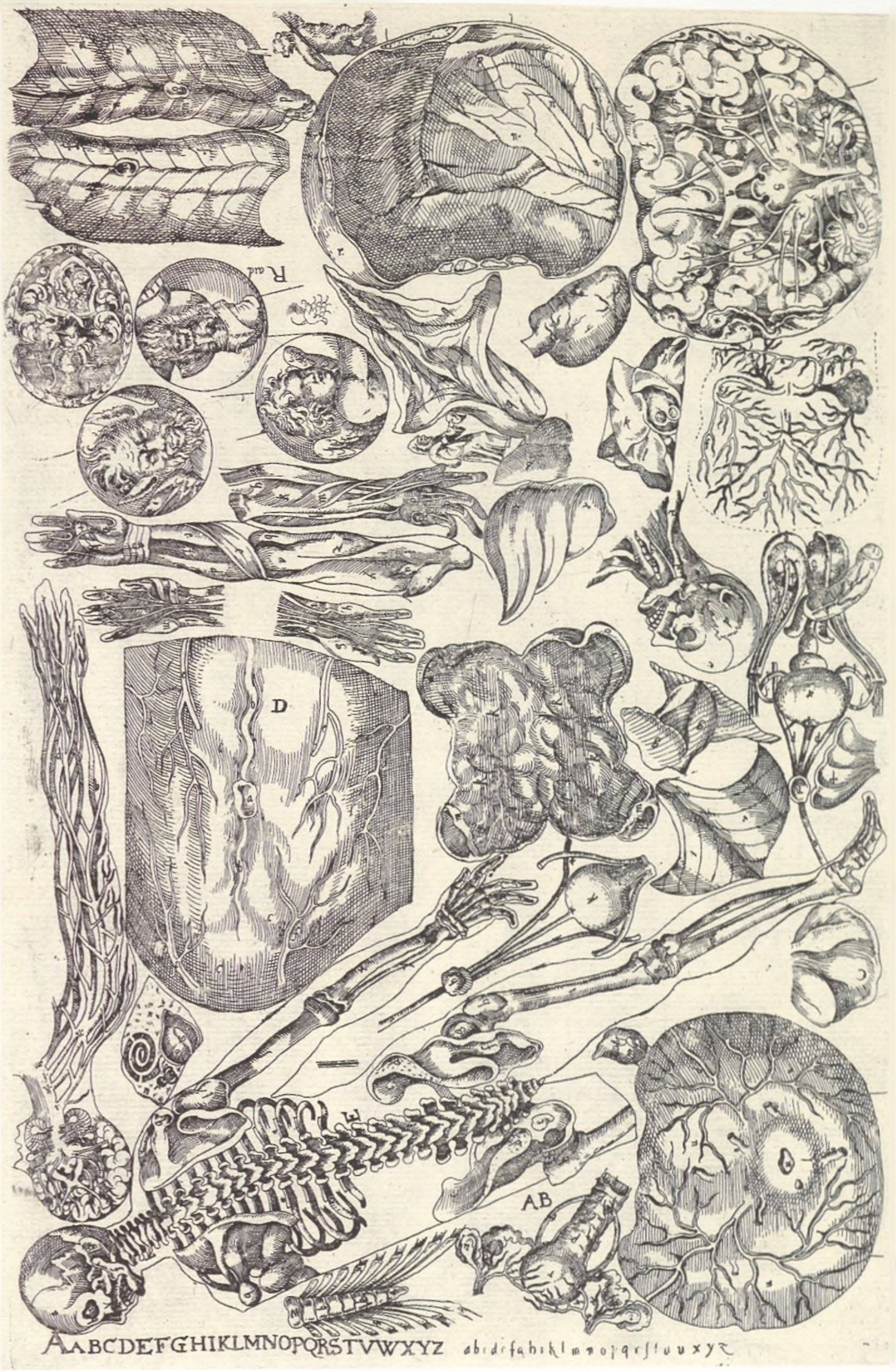


76. Lucas Kilian (German, 1579–1637). Uncut restrike printing of the *First Vision (Visio Prima)* from *Mirror of the Microcosm (Catoptrum Microcosmicum)*, 1754.

Engraving on ivory laid paper; image/plate: 373 x 281 mm (14 11/16 x 11 1/16 in.); sheet: 450 x 375 mm (17 3/4 x 14 3/4 in.). Galter Health Sciences Library Special Collections, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, oversize 611 P58 1754 (not in exhibition).

schematics of the design fell more to Remmelin than to the artist he claimed not to have employed.

Despite his protestations, Remmelin was not entirely disassociated from the 1613 sheets. On a column at the bottom left of the first sheet (the *First Vision*) appears his portrait, with his initials below: *I. R. Inventor.* The portrait matches a larger image, likely also by Kilian, in the 1619 book. The coat of arms in the right column also belongs to the doctor. Arguably, these clues would only have been decipherable to Remmelin's acquaintances, but his contribution is given equal billing to that of the publisher, Stephan Michelspacher, whose full name appears below the right column. Of the eight original 1619 plates, which were reprinted in a 1754 Italian work on anatomy spuriously attributed to the sixteenth-century doctor Archangelo Piccolomini, three were for the main engraved images of the three broadsheets, while the five others contained etchings of the underlying flaps (see figs. 77–78). The latter group, curiously, does not exactly match any state of the print, as some of the organ flaps are fragmentary or missing, while others appear in duplicate. The bulk of them, however, appear first on the 1619 edition, but bear great similarity to the preliminary versions in the 1613 first state. The three main plates were augmented with additional images of organs and other engraved details around 1619, but despite showing significant wear from the approximately six subsequent editions published by 1754, their shared scale and consistent number of scratches show they are in fact the originals used in the 1613 state as well.

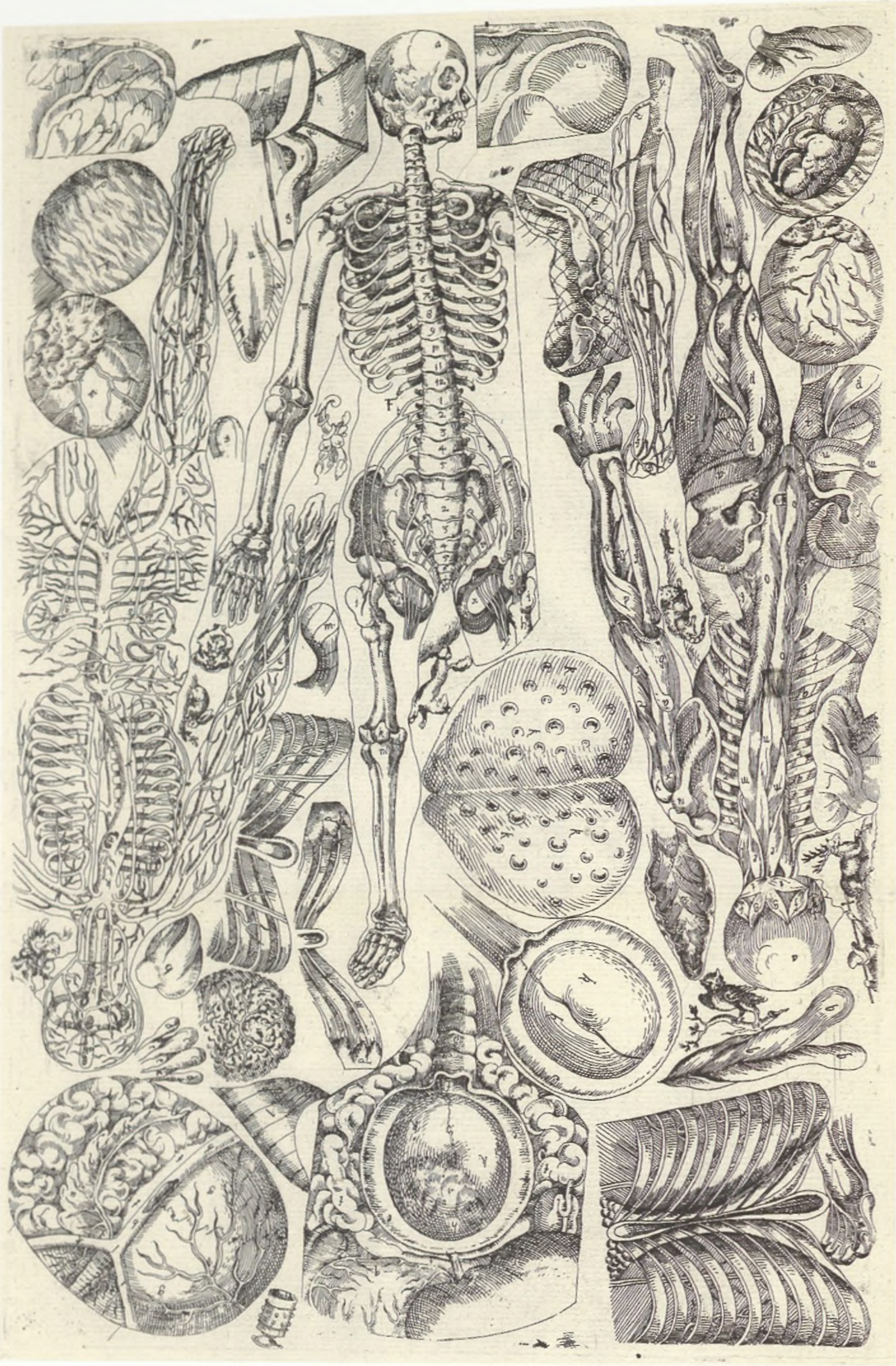


77. Lucas Kilian (German, 1579–1637). Uncut restrike printing of an anatomy flaps plate with alphabet, from *Mirror of the Microcosm* (*Catoptrum Microcosmicum*), 1754.

Etching on ivory laid paper; image/plate: 305 x 193 mm (12 x 7⅝ in.); sheet: 385 x 335 mm (15³⁄₁₆ x 13³⁄₁₆ in.). Galter Health Sciences Library Special Collections, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, oversize 611 P58 1754 (not in exhibition).

Though unsigned, the uncut restrikes of the flap plates reconfirm the identity of their artist. While Kilian engraved the surface sheets for the three *Visions*, the interior layers appear to be exclusively etched, a medium in which he worked less frequently. One of the plates lays the organs out in uncrowded rows and initially seems to display the ever-curving engraved line, but closer inspection under a microscope reveals that it is instead very finely etched. This plate includes variations on the flaps adhered on top of the first layer, especially a flower and a cloud of smoke to cover Adam's and Eve's genitalia. While all the other organs on this plate repeat examples on other plates, these two ersatz fig leaves seem to be explicitly etched in imitation of engraving. This was perhaps done so they would not look out of place on the engraved surface of the broadsheets and to allow them to merge seamlessly with the lower half of the cloud of smoke and the flower's stalk, each conveniently covered with a banderole that simplifies the joining process. The 1613 sheets do not include impressions from this plate, but rather actual engraved versions of these smoke and flower flaps that appear to have been the etchings' source. As these flaps may be the only ones from this plate that appear in the 1619 and subsequent editions, it must be seen as a transitional plate of engraving-like etchings, given that an actual engraved version preceded it. This preference for engraving over etching persisted. In 1645, Abraham Bosse noted in his etching manual's introduction that the main goal of etching was to imitate engraving.[23]

In the other four of the five organ plates, the innards appear to be arranged purely by fit rather than by order of construction, and even more curiously, tiny doodles fill the extra space around the flaps in a sort of macabre *horror vacui* (see figs. 77–78). Though they do not appear as visible flaps in any impression known to this author, two variations on Remmelin's coat of arms are drawn into separate plates, perhaps to suggest his connection to those illustrations as well. In some constructed impressions of the 1619 state, edges of the smaller doodles and an engraved line of the alphabet can be seen under and around the pasted-in flaps. As there is too little space to cut around them, they become makeshift tabs to secure the flaps. These creative doodles tie the underlying flaps back to Kilian. Though nearly invisible in the finished product, the tiny beer



78. Lucas Kilian (German, 1579–1637). Uncut restrike printing of another plate of anatomy flaps, with beer stein (lower right), from ***Mirror of the Microcosm (Catoptrum Microcosmicum)***, 1754.

Etching on ivory laid paper; image/plate: 305 x 193 mm (12 x 7⅝ in.); sheet: 385 x 335 mm (15³⁄₁₆ x 13³⁄₁₆ in.). Galter Health Sciences Library Special Collections, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, oversize 611 P58 1754 (not in exhibition).

stein, dancing bears, and floral swags have parallels in his 1627 *Alphabet* book and in a series of ornament prints he produced around 1607. Stephan Michelspacher of Augsburg, who published the *Catoptri* plates in 1613 and their book version in 1619, must have approached Kilian to carry out the changes on the original plates as well. The frontispiece to the 1615 handbook includes an illustration of anatomical details similar to the artist's flaps of the venous system. It is also attributable to Kilian, who produced other work for the publisher during this period. Remmelin too continued publishing with Michelspacher after 1619, so his supposed displeasure with the early printing does not appear to have complicated their business relationship.

While documenting a first draft of sorts, the Chicago Kilian impressions are unique in other ways. As is common among flap prints, they are missing a few organs, though not the loose ones hidden at the very interior of Adam and Eve's bodies. Those have migrated slightly, leaving Adam literally in possession of Eve's heart (see fig. 61). The general wear and tear on the sheets suggests the set was in fact used for study; it is even patched in places to keep the flaps attached. In particular, the Eve in the *Third Vision* appears to have attracted the attention of a censorious individual. Despite the large plume of smoke and the etched fluttering cloth flap once attached on top of the main engraving but now missing, there is a thumbprint-sized smudge of darkened brown material coating her genitals (see fig. 75). If this was done out of religious conviction, the gesture failed; condemning a modestly hidden layer only draws more attention to the area when the flaps are lifted. The uncut restrike impression shows the objectionable details unobscured, including Eve's pubic hair. It also includes the banderole where the flap of smoke attached to the surface of the engraving, extending tantalizingly into the viewer's space. Letterpress text on the verso of the 1613 smoke flap cites a variation on Psalm 102: 4 (Psalms 102: 3 in the King James version): "For my days are consumed like smoke, and my bones are burned as an hearth," a quote with sexual connotations in this context, especially as the fire consuming the immortal phoenix issues from beneath Eve's loins.

X-ray fluorescence spectroscopy indicates that the substance added to Eve's nether regions contains iron (see Kimberly Nichols's chapter). While iron gall ink would be the expected material to censor an image, the spot does not show the normal damage associated with this ink, particularly the weakening of the paper around its edges. Other possibilities for this material could be an oil, an adhesive (which would have both censored the area and awkwardly kept the entire group of flaps closed), or, more curiously, blood. While this conjecture is unlikely to be proven or disproven without DNA testing, the application of human or animal blood in this particular spot in fact suggests less an act of censorship than a viewer's recognition of Eve's menstrual cycle. Renaissance women of childbearing years rarely experienced menses as they spent much of their married lives producing children, with little pause. The family chronicled in the Regiomontanus *Calendar* is typical, and the lamented Christina could have died in childbirth. If Eve's mysterious covering is in fact blood, perhaps a woman applied it in hope—or fear—of becoming pregnant. Though the broadside of Eve was printed without a fetus, the torso displayed on the first sheet of the set originally contained one, as was usual for the genre. Curiously, this particular impression lacks the uterus flap. Could the same woman have removed it?

Kilian and Remmelin's *Catoptri Microcosmici* represents one of the last great interactive print series of the later Renaissance. These prints have been cursorily discussed for their allegorical motifs and the inherent violence suggested by cutting up printed bodies into so many pieces.[24] Yet much more can be gleaned from close inspection of the prints themselves. The popularity of the conceit is apparent in the six reprintings of the 1619 state of the Kilian plates with German and Latin text; another set of plates was copied from the 1613 edition for the Netherlandish and English markets. These works held a fascination that long outlived the accuracy of their anatomical content, which contributed to the preservation of the 1619 plates for reprinting as uncut sheets in 1754, a much longer life span than even Danfrie's astrolabe. By investigating the complete rich visual and textual context of printmaking, including paper evidence and visual clues in restrikes from plates and instruction manuals, one gains a much fuller understanding of the print's possibilities when it transcends the flat page and enters the third dimension.

32. Some coffers were turned into alms boxes after the fact; an example in the Bibliotheque nationale de France (Ea. 5.1 Rés.) has had a long gash cut through the side of an *Annunciation* print from the same workshop that has mistakenly been pasted in upside-down, perhaps as a result of the speed of manufacture.

33. Michel Huynh and Séverine Lepape, "Beau comme la rencontre fortuite d'une image et d'une boîte: les coffrets a estampe," *La revue des musées de France, La Revue du Louvre* (forthcoming 2011).

34. During the Renaissance, consecrated altars had relics or communion wafers inside, a continuing practice. See Peter J. Elliot, *Ceremonies of the Modern Roman Rite: The Eucharist and the Liturgy of the Hours* (Ignatius Press, 1995, rev. ed. 2005). The Setting for the Liturgy states: "The relics of a saint, not necessarily a martyr, should be placed beneath the *mensa* (tabletop) of a new fixed altar when it is dedicated. . . . The relic must be authentic and an identifiable part of the body of a saint, kept in a reliquary built into or located within the substructure of the new altar," pp. 22–23.

35. At least twelve of the twenty-two boxes in the Jammes sale have the secret compartment. Of the *Nativities*, the Chicago, Jammes (18), and Turin sheets are in boxes with flat lids allowing for the secret compartment and, judging from the vertical damage, so was the Zurich box, and the more intact detached sheet from the Bibliotheque nationale de France. The separate planks constructing the deeply arched cover (without a secret compartment) of the Metropolitan Museum of Art, Musee des Beaux-Arts, and Figdor boxes leave a distinctive horizontal tear through each woodcut that can also be seen in the National Gallery of Art detached sheet.

36. In the New York Public Library, a ribbon postdating the original assembly of the *God the Father* box was tacked on the left side to hold it open.

37. Karl Kup, "A Fifteenth Century Cofferet," *Renaissance News* 9, 1 (Spring 1956), pp. 14–19. The Art Institute's *Nativity* box measures 220 x 330 x 150 mm, while the New York Public Library's *Saint Francis* measures 120 x 80 x 60 mm (Spencer Coll. French 1490). A *Vera Icon* (Jammes 12), at 73 x 105 x 66 mm, and *Ecce Homo* (Jammes 11), at 73 x 112 x 64 mm, are even smaller than the Saint Francis.

RELIGIOUS PRINTS AS SUBSTITUTE OBJECTS

1. William Ivins's "exactly repeatable pictorial statement" does not represent precisely the way prints were perceived, but Peter Parshall suggests the literalness of early modern interpretations of the factuality of printed images. William M. Ivins, *Prints and Visual Communication* (Harvard University Press, 1953); Peter Parshall, "Imago Contrafacta: Images and Facts in the Northern Renaissance," *Art History* 16 (1993), pp. 554–79.

2. The original title of the *Heiligthumsbuch* (Reliquary Book) is *Dye zaigung des hochlobwirdige hailigthums der Stifft kirchen aller hailigen zu wittenburg*. *Heiligthumsbuch*, Aiii-iv.

3. *Heiligthumsbuch*, unpaginated second-to-last page.

4. This important affirmation of faith remains central to Catholic, Episcopalian, Lutheran, and other sects.

5. Mitchell Merback, "Torture and Teaching: The Reception of Lucas Cranach the Elder's Martyrdom of the Twelve Apostles in the Protestant Era," in "The Reception of Christian Devotional Art," ed. Pamela M. Jones, special issue, *Art Journal* 57, 1 (Spring 1998), pp. 14–23.

6. The copy promised by Dorothy Braude Edinburg to the Harry K. and Bessie K. Braude Memorial Collection includes only the separately dated 1548 Apostles' Creed; the dedication and Luther commentary appeared in a 206-page first part from 1547 entitled *Hortulus Anime*, an extended gloss by Luther on the catechism. Many of the *Heiligthumsbuch* woodcuts were reused there as well.

7. Germanisches Nationalmuseum, HB 2829.

8. Edith Warren Hoffmann, "Some Engravings Executed by the Master E. S. For the Benedictine Monastery at Einsiedeln," *Art Bulletin* 43, 3 (September 1961), pp. 231–37; Peter Schmidt, "Die Kupferstiche des Meisters E.S. zur Wallfahrt nach Einsiedeln: Einige Überlegungen zum Publikum, Programm und Kontext," in *Festschrift fur Dieter Wuttke zum 65 Geburtstag*, ed. Stephan Fussel (Harrassowitz Verlag, 1994), pp. 293–312.

9. Peter Schmidt, "Beschriebene Bilder. Benutzernotizen als Zeugnisse frömmer Bildpraxis im späten Mittelalter," in *Frömmigkeit im Mittelalter: Politisch-soziale Kontexte, visuelle Praxis, körperliche Ausdrucksformen*, ed. Klaus Schreiner (Fink, 2002), pp. 347–84, esp. 368.

10. British Museum, 1845,0825.380.

11. For dressed prints, see the Morgan Library, New York, and the Victoria and Albert Museum, London. See Audrey Adamczak, "L'imagerie de mode detournée: les portraits de cour 'découpés' de la Morgan Library," *Nouvelles de l'estampe* (forthcoming). For devotional uses of fabric in prints, see Evelyne M. F. Verheggen, *Beelden voor passie en hartstocht. Bid- en devotieprenten in de Noordelijke Nederlanden, 17de en 18de eeuw* (Walburg Pers, 2006), pp. 62, 113, 173–76.

12. Album 221 ("Andachtsbilder und Gebete") at the Kunstsammlungen der Fürsten zu Waldburg-Wolfegg includes numerous sheets of early seventeenth-century examples.

13. Franz Niehoff, ed., *Maria allerorten: Die Muttergottes mit dem geneigten haupt, 1699–1999: Das Gnadenbild der Ursulinen zu Landshut, Altbayerische Marienfrommigkeit im 18. Jahrhundert*, exh. cat. (Museen der Stadt Landshut, 1999), p. 282, cats. I/48b, g; I/50g; and II/63 a–j.

PRINTED SCIENTIFIC OBJECTS

1. "Science" is an anachronistic term to apply to Renaissance practices, though experimental studies were already being performed by special societies in the fifteenth century. According to Merriam Webster's (11th ed.), the term was first used with this meaning in a Latin form, *sciens* or *scientis* (also meaning knowledge), in 1589. But several of the devices produced with paper components functioned effectively the same as those now known as "scientific instruments."

2. The notes are difficult to read. Christina (mentioned with the last names Peterzolerni and Stribolig) died on October 23, 1501; Elizabeth was born on April 8, 1480, and died on April 26 of that year; Julius was born on March 8, 1486, and lived twelve days; Johannes is mentioned on August 8 and September 29, 1489; and on September 21, William is mentioned without a year.

3. The upper part of the jointed arm establishes the user's geographical latitude, and the bead is moved on the string to indicate the zodiac sign for the time of year. Then the user angles the device to align a peephole drilled through two rectangular sights at the top with the height of the sun. The bead's final position shows the local time.

4. Larry Silver, "Shining Armor: Maximilian I as Holy Roman Emperor," *Art Institute of Chicago Museum Studies* 12, 1 (Autumn 1985), p. 14.

5. In Ratdolt's 1478 *Calendar* at the Bavarian State Library, which reuses the same title page, the uncolored frontispiece shield has two stars added in brown ink and initials (possibly ME), above. A. Hyatt Mayor, *Prints and People: A Social History of Printed Pictures* (Metropolitan Museum of Art/New York Graphic Society, 1971), fig. 211.

6. See Suzanne Karr Schmidt, "Georg Hartmann and Instrument Printing in Nuremberg" and related catalogue entries in *Prints and the Pursuit of Knowledge in Early Modern Europe*, exh. cat., ed. Susan Dackerman (Harvard Art Museums/Yale University Press, 2011). The exhibition will appear at the Harvard Art Museums (September 5–November 28, 2011) and the Block Museum of Art at Northwestern University (January 17–April 8, 2012).

7. Germanisches Nationalmuseum, HB 14336/1206. For an image, search "hb 14336" on www.bildindex.de.

8. British Museum, 1871,1115.12.

9. The cities listed on the Charles Bloud sundial compass rose are arranged clockwise from north (12): Paris, Lyon, Rouen, Brussels, Rome, Toulouse, Venice, Milan, La Rochelle, Marseille, London, Amsterdam, Rheims, and Dieppe, for a range from 42 degrees north (Rome) through 51 degrees north (Amsterdam).

10. Bruce Chandler and Clare Vincent, "Three Nürnberg Compassmacher: Hans Troschel the Elder, Hans Troschel the Younger, and David Beringer," *Metropolitan Museum Journal* 2 (1969), pp. 211–16.

11. Complete unmounted sets of the kit are in Wolfenbüttel and the New York Public Library. Constructed printed astrolabes by Georg Hartmann (1542), Johannes Krabbe (1583), and Philippe Danfrie (1584) are at the Oxford Museum of the History of Science. See Suzanne Karr Schmidt, "Krabbes Papierastrolabium," in *Die Sterne Lügen Nicht: Astrologie und Astronomie im Mittelalter und in der frühen Neuzeit*, exh. cat., ed. Christian Heitzmann (Herzog August Bibliothek, Wolfenbüttel, 2008), pp. 117–21.

12. Anthony Turner, "Paper, Print, and Mathematics: Philippe Danfrie and the Making of Mathematical Instruments in Late Sixteenth Century Paris," *Studies in the History of Scientific Instruments: Papers Presented at the 7th Symposium of the Scientific Instruments Commission of the Union internationale d'histoire et de philosophie des sciences*, ed. Christine Blondel (Rogers Turner Books, 1989), pp. 22–42, esp. 31–32.

13. Ibid., pp. 26–27.

14. Ibid., pp. 32–33.

15. Jean Moreau, *L'Usage de l'un et l'autre astrolabe particulier et universel* (Paris, 1623), f. 2r–v, reads: "Amy lecteur, Ayant recognu de long temps que la curiosité portoit plusieurs personnnes non seulement à rechercher vne grande quantité de diuers instruments Mathematiques . . . i'ay peu trouuer de planches grauees de diuerse figures d'Instruments Mathematiques, comme d'Astrolabe, Cilindre, Radiometre, Graphometer, Trigometre, Horologes, & autres, afin qu'en faisaint tirer vn grād nombre de coppies la chose peut estre comune à tous."

16. Kenneth F. Russell, *A Bibliography of Johann Remmelin the Anatomist* (J. F. Russell, 1991). Of twelve 1613 impressions, seven are in the United States: Art Institute of Chicago; College of Physicians, Philadelphia; National Library of Medicine; University of California, Los Angeles; Cushing/Whitney Medical Library at Yale University, New Haven; New York Academy of Medicine; and University of Kansas Medical Center. Five more are in Europe: Staatsbibliothek, Berlin (destroyed in World War II), Germanisches Nationalmuseum, Nuremberg; University of Leiden; Waller Collection at Uppsala Universitetsbibliothek, Sweden; and University of Wroclaw, Poland. Two different printings of the 1613

sheets are known, with one variant with the date in the border at Nuremberg, and another without, at Chicago, New Haven, and others.

17. Kilian appreciated Albrecht Durer's work and engraved a double portrait of him, likely in 1628, the centennial of his death. British Museum, E, 3.6.

18. Videos showing the operation of several woodcuts from Heinrich Vogtherr the Elder's blocks (1544 from same block; 1564 and 1580–1600 both close copies) are shown on the Wellcome Library website: http://catalogue.wellcome.ac.uk/search/o?SEARCH=digfugitive.

19. Tim Huisman, *The Finger of God: Anatomical Practice in 17th-Century Leiden* (Primavera Pers, 2009), pp. 38, 50. Pauw's successor, Otto Heurnius, acquired prints and books from the dealer Govert Basson for the anatomy theater on August 12, 1618. The purchase included a set of the 1613 Remmelin/Kilian broadsheets and the 1614 manual.

20. The watermark is similar to Piccard 26554, an *M* in a circle, dating to circa 1614 and used in Augsburg.

21. *Captotrum Microcosmicum*, 1619. *Visio Tertio* (Eve) describes the use of the lungs and heart (B) and diaphragm (C) as elements that are meant to be removable: B: *Pulmones & Cor in thoracis. Cavitate ubi Imnooo sternu est, notat, quae facile eximuntur*; C: *Diaphragm, ventriculum, hepar, quae eximuntur pingit*.

22. The translation comes from Russell (note 16), p. 3.

23. Abraham Bosse, *Traité des manieres de graver en taille douce sur l'airin* (Paris, 1645), p. 3

24. David Hillman and Carla Mazzio, eds., *The Body in Parts: Fantasies of Corporeality in Early Modern Europe* (Routledge, 1997), pp. xv–xvii.

"AFFIXED AND ORDERED" PRINTMAKING

1. Beatrice Hernad, *Die Graphiksammlung des Hartmann Schedel*, exh. cat. (Bayerisches Staatsbibliothek/Prestel, 1990), p. 121; Peter Parshall, "The Print Collection of Ferdinand, Archduke of Tyrol," *Jahrbuch der Kunsthistorischen Sammlungen in Wien* 78, 42 (1982), p. 140.

2. Placidus Sprenger (1735–1806) was a Benedictine monk, historian, and (from 1777–96 and 1799–1803) the monastery librarian at Banz, now Bad Staffelstein, north of Bamberg. He also served three years (1796–99) as prior at the Stefanskloster in Würzburg. The monastery was secularized in 1803, soon after Sprenger completed the album, at which time the library may have been dispersed. Franz Xaver von Wegele, *Allgemeine deutsche Biographie und Neue deutsche Biographie*, v. 35 (Duncker und Humblot, 1893), pp. 304–05.

3. "Die Zukunft kann das Fehlende noch ergänzen, besonders wenn einmal die in Rittersitzen, kleinen Konventen, und sonst noch auf dem Lande im Staube ruhenden alten Bücherschätze von Liebhabern durchwühlt werden." Placidus Sprenger, *Aelteste Buchdruckergeschichte von Bamberg* (Grattenauerischen Buchhandlung, 1800), p. IV.

4. Two Bamberg Virgins appear on pages 31 and one on 34; the advertisement is on page 120.

5. Peter Schmidt, "The Early Print and the Origins of the Picture Postcard," in *The Woodcut in Fifteenth-Century Europe*, Studies in the History of Art 75, Center for Advanced Study in the Visual Arts, Symposium Papers 52, ed. Peter Parshall (National Gallery of Art/Yale University Press, 2009), pp. 238–57.

6. Sprenger organized the volume in several sections: the life of Christ (pp. 1–16), Christ and communion (pp. 17–21), the life of Mary (pp. 22–43), angels (pp. 44–47), a roughly alphabetical organization of saints (pp. 48–98), and leftover saint's days prints from a single eighteenth-century source (pp. 99–108). A miscellany of seventeenth- to eighteenth-century portraits of cardinals and other prints follows (pp. 107–30).

PHYSICAL QUALITIES OF EARLY PRINTS

1. See Peter Parshall and Rainer Schoch, "Early Woodcuts and the Reception of the Primitive," in *Origins of European Printmaking*, ed. Peter Parshall and Rainer Schoch (Yale University Press, 2005), pp. 1–17.

2. In early printings of *Saint George* and *Maximilian*, Cranach and Burgkmair initially printed the key block first in black and then applied the color line block; later Burgkmair reversed this order, as in the Art Institute's impression. Perhaps the initial application of color over black ink derived from the chiaroscuro drawing technique of applying highlights over black ink lines. For more information on developments in chiaroscuro printing between 1507 and 1510, see David Landau and Peter Parshall, *The Renaissance Print: 1470–1550* (Yale University Press, 1994), pp. 184–91.

3. The presence of gold powder was confirmed through X-ray fluorescence (XRF) spectrometry. Analysis was performed at the Art Institute of Chicago using a Bruker/Keymaster TRACeR III-V energy dispersive X-ray fluorescence analyzer, with a Peltier cooled advanced high-resolution silver-free SiPIN detector and a rhodium (Rh) transmission target with maximum voltage of 45kV and tunable beam current of 2–25mA. The size of the analyzer spot may vary, but is approximately 6–8 millimeters in diameter.

4. Producing powdered gold paint for use in tempera and illuminated manuscript painting involved a fastidious process of grinding gold leaf with honey in a glass mortar to form a paste, then washing the paste several times to remove the honey while allowing the gold to settle out each time. Eventually the gold would dry and be combined with a binder. See Ralph Mayer, *A Dictionary of Art Terms and Techniques* (Thomas Y. Crowell Company, 1975), p. 171.

5. Larry Silver, "Shining Armor: Maximilian I as Holy Roman Emperor," *Art Institute of Chicago Museum Studies* 12, 1 (Autumn 1985), pp. 8–29.

6. Michael L. Ryder, "The Biology and History of Parchment," in *Pergament: Geschichte, Struktur, Restaurierung, Herstellung*, ed. Peter Rück (Jan Thorbecke Verlag, 1991), p. 26. Also see Matt T. Roberts and Don Etherington, *Bookbinding and the Conservation of Books* (Library of Congress, 1982), p. 277.

7. Paper mould characteristics are most apparent when a sheet is viewed in transmitted or raking illumination. The traditional western laid mould is constructed of perpendicular, closely spaced wires affixed to a wooden frame that trap the fibers and allow the water to drain away when the mould is dipped into the vat of rag fiber and water slurry. The more widely spaced "chain" lines run perpendicular to the laid lines and secure them in position.

8. Dard Hunter, *Papermaking: The History and Technique of an Ancient Craft* (Alfred A Knopf, 1943), p. 172.

9. For more information on surface texture and its effect on impression quality, see Andrew Robison, *Paper in Prints* (National Gallery of Art, 1977), pp. 7–10.

10. E. Lunning and R. Perkinson, *Print Council of America's Paper Sample Book: A Practical Guide to the Description of Paper* (Print Council of America, 1998), p. 8.

11. Parshall and Schoch (note 1), p. 2.

12. Lisha Glinsman Fletcher and Doris Oltrogge, "The Pigments on Hand-Colored Fifteenth-Century Relief Prints from the Collections of the National Gallery of Art and the Germanisches Nationalmuseum," in *The Woodcut in Fifteenth-Century Europe*, ed. Peter Parshall (Yale University Press, 2009), pp. 277–97. For additional technical research into early colored woodcuts, see Thomas Primeau, "The Materials and Technology of Renaissance and Baroque Hand-Colored Prints," in *Painted Prints: The Revelation of Color in Northern Renaissance and Baroque Engravings, Etchings and Woodcuts*, exh. cat., ed. Susan Dackerman (Baltimore Museum of Art, 2002), pp. 49–78.

13. Kenneth F. Russell, *A Bibliography of Johann Remmelin the Anatomist* (J. F. Russell, 1991).

14. The papers of the etchings and the main engraving differ. The engraving paper is slightly thinner (.14–.16 millimeters). The chain lines are generally spaced 25 millimeters apart and an early seventeenth century Augsburg watermark (1614) was identified in one of the sheets (see http://www.piccard-online.de/?nr=26554, for an image of the watermark). The etching paper is slightly thicker (.17–.19 millimeters). The chain lines are spaced approximately 23–24 millimeters apart and a partial watermark in visible in one of the prints. It is not identifiable, though it appears to be different from the watermark in the engraved print paper.

15. Horizontal distortions are most visible in the exterior engraved support. They result from the orientation of the paper fibers established during formation of the paper sheet.

16. The identification of iron was achieved with XRF spectrometry at the Art Institute of Chicago as described in note 3. Further analysis of a microscopic sample with Fourier Transform Infrared spectroscopy identified silicates and oxalates (most likely iron oxalates) indicative of a highly oxidized organic material.

17. Ibid.

18. Catherine Lynn Frangiamore, *Wallpapers in Historic Preservation*, National Park Service Publication 185 (Government Printing Office, 1977), pp. 3–11.

19. The term "distemper" designates aqueous paints made with a simple hide or gelatin size or casein binder, and is often used to describe bulk or wall paints. Misinterpretation arises from the use of the term "distemper" as a translation of the French term *détrempe*, which refers to both distemper and tempera. Ralph Mayor, *The Artist's Handbook of Materials and Techniques*, 4th ed. (Viking Press, 1981), pp. 626–27.

20. Elisabeth West Fitzhugh, "Red Lead and Minium," in *Artists' Pigments: A Handbook of their History and Characteristics*, vol. 1, ed. Robert E. Feller (Cambridge University Press, 1986), p. 115. The formation of lead sulfide on the surface layer of lead-based pigments can produce a distinct silvery gray film; in extreme cases the pigment can appear matte black.

21. The ruling was added rather unskillfully, possibly by the same hand; though the width of the pen nib changes (ranging from .75–1 millimeter at its narrowest to 1.50–2 millimeters at its thickest), the handling and ink type remain remarkably similar. In most cases, the prints appear to have been ruled after they were cut from their sources.

22. See p. 93 in this book.